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A PLEA FOR THE PLODDER.

The new president of the English Institution of Electrical Engineers, William Duddell, F. R. S., speaking with all the authority which attaches to one who, during his term of office, is official head of close upon seven thousand electrical men, has uttered a warning against becoming narrow in ideas. He appealed, in his inaugural address, to his members not to limit themselves as a body too much to one branch of electrical industry, and he argued that if an engineer is properly defined as one who directs the great sources of power in nature for the use and convenience of mankind, the term electrical engineer should include anyone who applies electricity in any way so that it may ultimately be of benefit to the human race. There can be little doubt, as he says, that the Institution tendency has been to deal with generation, distribution, and the cost of electrical energy, in many cases only dealing with them as large general questions. Yet the proportion of the total membership engaged in the actual scheming or designing of large things must be small and the great bulk of the profession "must naturally be occupied in working in their own groove in life." It is in the interests of these that the new president has drawn attention to the matter, holding as he does that "details—small things—are very often of the greatest importance," for in many cases the success of a big scheme or a big plant mainly depends upon the attention that has been bestowed on its detail.

Progress in the application of electricity and with it the advancement of the industry, can only be secured "when engineers take as wide a view as possible of everything that concerns their profession." They should not live in a water-tight compartment bounded by the limits of their own special subjects.

There is a borderland or fringe between electricity and the other sciences wherein a large number of scientific workers are quietly at work—employed today upon a laboratory experiment which tomorrow might form the basis of a large industry. Mr Duddell would not have the interests of this class ignored, and there is reason to believe that his advocacy will receive sympathetic support from large numbers of humble workers whose doings are seldom brought out into the lime-light of publicity, but who nevertheless are rendering invaluable service in the general electrical cause.

ELECTRICAL APPARATUS IN THE HOUSEHOLD.

In one section of his presidential address to the Institution of Electrical Engineers in London, Mr. Duddell referred to the absence of papers in the past dealing with the design and construction of apparatus for household use, such as fittings, heating and cooking apparatus. To extend domestic uses it was most important that the apparatus should be really appropriate to its use. When we come to deal with fittings and other apparatus for use in our homes, we cannot wholly look upon the matter from the strictly engineering point of view. Many of our household articles are things with which we have been familiar since childhood. We have grown up with them, and we have become so used to them that we have a tendency to think that they are the only possible things to serve their purpose, so that when a proposal for a change comes, it comes almost as a shock. In England so accustomed have people become to the open fire that the acceptance of the suggestion that any other form of heating is as good involves a complete change in one's ideas. The substitution of gas for candles involved quite a considerable change in lighting methods, yet even after 100 years there still lingers in many minds an affection for the candle and the oil lamp!

"The great superiority of the electric light over all other forms of illumination has made the change from gas to electricity easier, but the designs of our electric-light fittings are still largely reminiscent of gas and candles." "The results of the attempt to combine the modern form of illuminant with early artistic designs is not always happy, either from the artistic or practical point of view."

Mr. Duddell, in touching upon the advance in electric cooking and heating apparatus during the last decade, said that there was one difficulty which was not often referred to when one compared electrical heating apparatus with heating by means of flames —namely, the difficulty of limiting the temperature rise. For convenience, for instance, to boil a kettle, it was necessary to be able to generate heat very quickly for a short time. It was quite easy to construct apparatus to fulfill this condition, but if such electrical apparatus were left in service continuously it might attain a temperature which would be injurious to it. This was not the case with flame heating, as there was always an upper limit of temperature, namely, that set by the flame itself. If materials could be obtained for heating apparatus which could be run continuously at a very high temperature, say in the neighborhood of white heat, then this difficulty would be largely overcome, because the dissipation of energy by radiation would rapidly become so great with rise of temperature that the final temperature would be reached before the heating arrangement was injured. A material with a very high positive coefficient of resistance change with temperature would serve the same purpose. A further advantage of possible high temperatures of the heating part is that it enables heat to be transferred from one place to another by radiation, a method of transferring heat which experience has proved to be very suitable for many heating and cooking purposes.

ELECTRIC POWER SURVEYS.

The installation of electricity in competition with other motive powers is clearly an engineering problem, and central stations which view it as such are reaping the reward of their painstaking work. Within the past five years the most progressive companies have taken up the so-called "power survey" as an essential feature of electrical applications recommended to prospective purchasers of motor service, and have embodied the results of their investigations in more or less complete reports submitted to the desired customer before the securing of the latter's name upon the significant dotted line. Considerable publicity has been given to this method of securing power business, and there is not much room for discussion as to its advantages, both from the standpoint of impressing the consumer-to-be with the precision and technical resources of the central station and from the viewpoint of the latter's record files. There is, however, need of emphasizing some of the important points which should be treated in work of this kind in order that the power survey and the recommendations based upon it may be of the utmost possible benefit to both the consumer and the company.

In too many cases, power surveys suffer from incompleteness and are of little value subsequently to the gaining of the business for which they are primarily prepared. A critical study of many of these documents discloses the frequent omission of such data as the sizes of existing boiler and engine plants, actual tests of steam consumption under commercial load conditions, lists of machines operated by the old system and the assumptions made as to interest, depreciation and other fixed charges entering the final determination of cost of service. The practice of taking indicator diagrams in order to estimate the average power consumption of the existing installations is generally followed, but on the basis of these tests, the power company too often depends upon a mere estimate of the steam consumption, assuming a fixed average rate of evaporation and fuel economy for the local conditions.

This lack of data is often excused on the ground that the report based upon the power survey is intended solely for the prospective consumer, and it is contended that as long as the latter knows what his equipment layout is, no need exists for putting it down in black and white in the recommendation of the central-station company. As a matter of fact, it is of no small importance to the latter to accurately list the machinery which it is proposed to drive by motors, no less than that already operated by a competitive motive power, the reason being that a given cost estimate applies to a stated layout of equipment, and when alterations come, as

they are almost certain to, in the future, the power company should not be held to a performance on the cost basis which is in any way indefinite or ambiguous. As for careful tests or measurements of plant performance, it is not open to question that a company which takes the pains to make these is in a much better position to forecast the savings possible by electricity than one which makes what is at best but an educated guess as to the fuel and water consumption of the installation. Many factory owners keep records of coal consumption which are practically worthless from the engineering standpoint, and the least that a power engineer should do in trying to determine present costs in advance of an electrical installation is to investigate the coal and labor requirements through a period sufficiently extended to give a line on the maximum expenditure to be anticipated for these items in a comprehensive estimate of total expenses. An analysis of the electrical service cost in relation to the loads determined by the indicator may show that the motor drive will result in a wide margin of increased efficiency in cost per unit of product, so that detailed tests of steam and fuel consumption will not be necessary, but in many cases, and especially where steam heating enters the problem, the margin is closer and fairly accurate data are absolutely necessary for the preparation of a safe estimate.

A power report of the best type, therefore, presents a general engineering description of the installation to be electrified; gives a sound estimate of its total yearly cost of operation, including fixed charges; contrasts this cost with the estimated cost, including fixed charges, of running the plant with electric drive on central-station power, including steam heating if required; and lists every motor and machine, with full information as to ratings, speeds and capacities. In many cases the report also includes blue prints showing the projected motor layout drawn to scale, and refers to similar installations which may be examined as more or less perfect models of electrical operation. The company that assembles its power-service material in this way accumulates a file of the greatest value, and is in a position to capture business upon exceedingly close margins.

ELECTRICAL DEVELOPMENT AND THE STEAM ENGINE.

The present year is the 200th anniversary of the invention of the reciprocating steam engine in a practical form. The first successful piston steam engine was built in 1712 by Thomas Newcomen in England. While Newcomen produced an engine which could be practically operated to advantage and was utilized for pumping in the English coal mines, it cannot, of course, be claimed that the invention of the steam engine is due entirely to him. Others before him had been working on the problem with partial success, and many others since his time have helped to perfect the idea which was represented in his crude machine. Some of the prior machines utilized steam on the vacuum principle for operating pumps, etc., but Newcomen's machine may be considered the forerunner of the modern reciprocating steam engine.

Especially is development in the electrical industry due to the previous invention and perfection of the steam engine, as without this aid one can hardly claim that electrical development would have reached its present high plane. While it is true that with the existence of water powers the generation of electrical energy upon a large scale is possible without the use of steam, hydroelectric developments are a later addition to the field of electrical engineering, and it must be admitted that electrical applications would not have achieved their present wide usefulness had the steam engine not been already available at the birth of electrical machinery.

PUBLIC RELATIONS.

At the meeting on November 22 of the Electrical Credit Association of Chicago, Mr. Harold Almert presented a scholarly address on the subject of "Public Relations." Mr. Almert handled his subject from the viewpoint of the executive of a public utility corporation rather than from the viewpoint of the public utility commissioner. He injected a good deal of sound sense into his discussion of this subject, and his address, which is published on other pages of this issue, will be found worth careful study. Mr. Almert's remarks with regard to limited-term franchises and his insistence upon the indeterminate franchise as a more equitable basis for the establishment of proper relations between the public service corporation and the public it serves, are instances where we believe fair-minded people will have to agree with him.

With regard to the ultimate disposition of the public-service corporation toward the public it serves, a healthy sign of the great progress that is now being made is the expression upon Mr. Almert's part that, viewed from a business standpoint, the possession of the public-utility franchise should be looked upon as a trusteeship to be administered in the interest not only of the company but the public as well. Also, that while in the past the problem of public relations was considered unimportant, today it takes precedence over all other factors of management.

In this connection the expression of Mr. Charles H. Cohn, vice-president of the Consolidated Gas, Electric Light & Power Company, in an address before the City Club of Baltimore on November 23, is of interest. Mr. Cohn says that while a good deal has been written about the obligations of public service corporations and the proper methods of meeting these obligations, and that while the companies have been told that it is "good business" policy to cultivate friendly relations, any such narrow-minded view of the duties and responsibilities prevents recognition of the rights of the public and a full discharge of the duties of the public-service corporation.

Obligations of Public-Service Corporations.

At a meeting of the City Club of Baltimore on November 23 an address was made by Charles M. Cohn, vice-president of the Consolidated Gas, Electric Light & Power Company, on "Obligations of Public-Service Corporations." Mr. Cohn spoke in part as follows:

"A great deal has been written and spoken about the obligations of public-service corporations and the proper methods of meeting these obligations. We are told that it is 'good business' to cultivate friendly relations with the public, and consequently we should be courteous under all circumstances and should give careful consideration to the multitudinous details involved in giving good and satisfactory service. The alluring prospect of gain is always held out as the reward of good conduct and is the inducement for fulfiling our obligations. It is this narrow view of the duties and responsibilities of public-service corporations that prevents recognition of the rights of the public and the full discharge of the duties of public-service corporations.

"It should be clearly understood that the performance of public duties by such corporations is not the conferring of a favor on the public, but the discharging of a duty which the public has an undoubted right to require.

"Public-service corporations are not philanthropic institutions, and their object in the conduct of their business is gain, but from the very nature of the business certain well defined obligations spring as long as the business is conducted, and these obilgations arise entirely independently of whether the discharge of them by the corporation is profitable to them or not.

"A better understanding of the reciprocal rights of the public and the duties of public-service corporations has been in a large measure accountable for the change of policy of public-service corporations during recent years. The fundamental duty is to serve the public. This basic fact underlying this duty is the dedication of property of public-service corporations to public uses in a manner which vitally affects the welfare, progress and development of the communities which they undertake to supply. From this primary duty arise the obligations to serve all that apply without exclusive conditions, provide adequate facilities to meet all demands of the consumer, exact only reasonable rates for the services rendered or commodities supplied, and between customers under similar circumstances make no discrimination.

"The path of success in public-service life is very much the same as the path in any other sphere of activity. It is merely the path of common sense. If a public-service employee sees the situation from the consumer's standpoint his task is already one-half accomplished.

"In conclusion just one word on the subject of regulation. This seems to be the prevailing philosophy of the people at this time. I venture to say that in about two-thirds of the states there are regulatory bodies of one sort or another. I believe as the result of these measures that there will be a far better understanding of the many perplexing problems of public-service work and a better feeling will be promoted between public-service corporations and the public. It is my judgment that state regulation will fully meet all requirements and will eventually result to the great advantage of the communities and pubic-service corporations alike."

Electric-Vehicle Meeting in New York.

Several hundred electric-vehicle men attended the meeting of the Electric Vehicle Association of America which was held at the Engineering Societies Building, New York City, on November 26. Arthur Williams, the new president of the Association, presided.

The greater part of the evening was spent in a discussion of the papers which were read at the third annual convention, held in Boston in October. In one of the papers dealing with the cost of electric-vehicle operation, it was stated that a 1,000-pound wagon effected a saving of $400 a year over a 1,000-pound horse equipment, and that a five-ton electric truck effected a saving of $1,100 a year over a horse equipment capable of doing the same work. These figures were gone into thoroughly and found to be correct.

Advertising was one of the important matters brought up. The members agreed that last year's advertising had accomplished good results; in fact the spirit of approval was so general that they expect to raise $100,000 for advertising next year, instead of $50,000, which was last year's appropriation.

Arthur Williams stated that the New York Electric Vehicle Association will probably soon take its place as a section of the Electric Vehicle Association of America.

A standard design for an official garage sign was adopted. It consists of white letters reading "Electric Vehicle Charging," on a blue background, with the emblem of the Association in the center. The sign is to be 4 feet long and 2.5 feet wide. It will be sent to garages everywhere in the United States which have electric-vehicle charging stations.

Drafting Public-Service Law for Illinois.

A joint committee of the Illinois State Legislature, consisting of five senators and five representatives, appointed in May, 1911, has been making an extended investigation of public-utility-commission legislation with a view to making recommendations along this line to the next legislature, which meets in January, 1913. The utility laws of those states that have commissions have been studied and the headquarters of some of the commissions visited. Hearings have been held in a large number of Illinois cities at which representatives of municipalities and of utility companies gave their opinions on the desirability of legislation creating one or more public service commissions and on the authority that should be vested in such commissions. The public hearings came to a close in Chicago on November 30, after a session of nearly two weeks in that city.

The Chicago hearings disclosed a reluctance on the part of most of the representatives of Chicago utility companies to coming out openly in favor of commission regulation, several contending that control by the City Council had proved fairly satisfactory. Mayor Harrison and several aldermen were loud in their praise of the principle of home rule and declared outright opposition to any curtailment of their authority. Striking testimony was brought forth that the Seventy-Cent Gas League, which played quite a role in the last municipal election, and greatly influenced the subsequent policy of the city administration in the regulation of gas rates, consisted in reality of but a few members and that the agitation in favor of the 70-cent rate was a pure case of demagogy without scientific or equitable basis, but merely to catch votes. Some sentiment was also expressed that, if commission regulation is inevitable, a separate commission should be created for Chicago after the practice in New York.

The joint committee will devote the rest of the time before the convening of the legislature to the preparation of its report, which doubtless will also include a draft of an act creating one or two commissions. The retiring governor and the governor-elect are both in favor of such legislation. Senator John Dailey, of Peoria, Ill., is chairman of the joint committee.

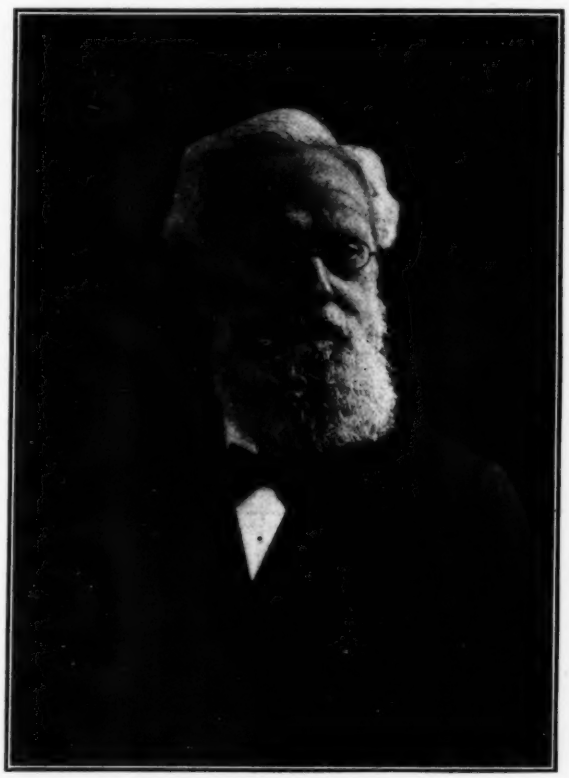
Professional Relations.

At the meeting of the American Institute of Consulting Engineers to be held on December 12 at 6:30 p. m., at the Engineers' Club, 32 West Fortieth Street, New York City, there will be a discussion of the question of professional relations.

B. W. Feddersen.

When about five years ago the "Gesellschaft deutscher Naturforscher und Aerzte" had a congress in Dresden, a certain sturdy old gentleman created by his presence considerable excitement. It was Dr. Bernhard Wilhelm Feddersen, whose name appears in every important German and many foreign books on physics, and is known to every one who has an intimate contact with that branch of knowledge, but concerning whom only a few knew at that time that he was living in Leipzig occupied with humanistic studies.

This great physicist was born in the town of Schleswig, March 26, 1832, hence has now passed his eightieth birthday. When 25 years of age he received his diploma at the University of Kiel, handing in a thesis on "Experiments in the Measurement of Different Forms of Electric Discharge." In the next year, 1858, he published in *Poggendorff's Annalen der Physik* his later very celebrated contributions to the knowledge of the electric spark. Up to 1874 he made a long series of experimental and theoretical researches in this branch, and published them in the reports of the Royal Saxon Scientific Association. His experiments continued the researches of Wheatstone, 1835, and other physicists, as to the length of duration of the electric spark, and the velocity of its transmission. But instead of observing a rotating mirror, as did his predecessors, he conceived the idea of photographing the image and further of determining the dependence of the discharge of the Leyden jar on the resistance of the completing circuit. As the photographic plate made a permanent record, he could make very accurate measurements.



Bernhard Wilhelm Feddersen,
Celebrated German Physicist.

In one arrangement, where the circuit was closed by a copper wire 1,300 meters long, Feddersen found that the record on the plate was no longer a single bright stripe but alternate dark and light ones, the supposed single discharge seeming to him to be composed of a series of interrupted smaller discharges of equal length, and with equal intervals. There was also the remarkable fact that the records of the single sparks seemed to run alternately in opposite directions. From this Feddersen drew the conclusion that the discharges were really vibrations or oscillations. In this he found many disagreed with him at first: and it was not until after the ingenious calculations and experiments of A. von Ottingen proved theoretically before the association named that he was right, that no more doubt in the matter remained in the minds of his colleagues.

This discovery, which forms the fundamental principle of wireless telegraphy, gave rise to the epoch-making experiments and discoveries of Heinrich Hertz.

An Illuminating Engineering Society in Germany.

The Illuminating Engineering Society in the United States was formed at the beginning of 1906, the corresponding society in London three years later.

An illuminating engineering society has now been formed in Germany, and reference to this important step was made in the "Summary of Progress During the Vacation" presented by Leon Gaster, at the first meeting of the Illuminating Engineering Society held in London on November 19.

Mr. Gaston explained that during his recent visit to Berlin he had an interview with Dr. Brodhun and Dr. Liebenthal at the Reichsanstalt, and furnished particulars of the constitution of the British Society, on which the German Society is evidently to be modelled.

The official announcement of the foundation of the German Illuminating Engineering Society is made in a recent number of the *Zeitschrift für Beleuchtungswesen*. For a long time there has been a recognized need in that country for a society capable of dealing with photometric standards and illumination generally in an impartial way. Accordingly delegates from the two most important bodies dealing with gas and electric lighting, the Verein für Gas und Wasserfachmänner and the Verband Deutscher Elektrotechniker, approached the Reichsanstalt, the government bureau corresponding to our Bureau of Standards, asking this institution, as an impartial body, to take the first step towards forming a new society. That the gas and electric-lighting representatives should co-operate in this way is regarded as a remarkable sign of progress, that would have been impossible a few years ago. A provisional committee has been formed of which E. Warburg, director of the Reichsanstalt, is to be the chairman, and Dr. Liebenthal, secretary. The committee will also have the assistance of Dr. Bunte and G. Dettmar, representing respectively the Verein für Gas und Wasserfachmänner and the Verband Deutscher Elektrotechniker.

It is anticipated that the first regular meeting will take place next February when Otto Lummer is to present a general address on progress in illumination.

Next Meeting of Southwestern Association.

At a meeting of the Executive Committee of the Southwestern Electrical and Gas Association, held on November 29, it was decided to hold the next annual convention at Galveston, Tex., May 21 to 24, 1913. Headquarters will be at the new Galvez Hotel.

The secretary of the Association is H. S. Cooper, 405 Slaughter Building, Dallas, Tex.

Tests of Insulators.

At the meeting of the American Institute of Electrical Engineers, to be held in New York City on December 13, under the auspices of the High-Tension Transmission Committee, two papers will be presented as follows: "Comparative Tests on High-Tension Suspension Insulators," by P. W. Sothman; "High-Frequency Tests of Line Insulators," by L. E. Imlay and Percy H. Thomas.

The Blackstone Valley Gas & Electric Company has announced a reduction in its lighting rate from 12 cents to 10 cents per kilowatt-hour, beginning with January 1, 1913. This reduction applies to the Pawtucket (R. I.) Division.

Photographs by Artificial Light.

At the first meeting of the British Illuminating Engineering Society, in London on November 19, J. S. Dow and V. H. Mackinney showed a number of interesting photographs taken by artificial light. Illustrations and good photographs are particularly useful in connection with illumination, but it is essential that for scientific purposes photographs should be taken only by artificial light, and not by flashlight, and that as little retouching as possible should be practised. Bearing in view the meager data available and the exposure by artificial light and the varying actinic power of the illuminants now in use, it is no easy matter to get an accurate and satisfactory photograph.

Mr. Dow explained that the problem of determining the best exposure had been solved by taking photometric measurements of the brightness of objects in the field of view with the Holophane Lumeter instrument. A good photograph of an artificially lighted interior should not only display the room exactly as it appears to the eye but should also indicate the actual light sources and illuminated shades without distortion and halation. Very careful exposure and development is often necessary to secure these conditions. Moreover, it must be remembered that it is hardly possible to secure a greater ratio of brightness than 30 to 1 in a photographic print, and this will be reduced still further in subsequent reproduction. Yet the variation in the subject itself met with may be enormous. It is therefore necessary to decide which are the elements in the picture that must be accurately portrayed. In this connection photometric measurements of the surface brightness of various objects in the room are most useful, since they tell one what an actinometer (even if practicable by artificial light) would not.

To illustrate these points Mr. Dow showed a series of lantern slides, all taken entirely by artificial light, of illuminated shops, offices, etc., pointing out in each case the intention of the photograph. Subsequently he referred to the difficulty of obtaining such photographs with people in the room, owing to the length of exposure generally necessary. By using a very rapid plate and a wide aperture, Mr. Mackinney and he had, however, been successful in taking a number of views of this kind showing specimens of good and bad lighting. Whether it would ever be possible to take snapshots, strictly speaking by ordinary artificial light was another matter. It might be possible by such illuminants as the inverted arc and the Moore tube, but at present it hardly seemed feasible in most installations using incandescent gas or electricity. They had made a few preliminary rough experiments with snapshots in the streets by night, and a couple of views taken in this way, showing not only the lights but people and vehicles moving about, were displayed. It was possible that in the future the discovery of a very much faster plate might lead to further progress in this direction.

Ionomagnetic Rotation.

A new phenomenon has been observed by Professor Righi, of Italy, to which he gives the name of ionomagnetic rotation. If a spark from a condenser of considerable capacity is sent horizontally through a gas and two small vertical vanes of mica in the form of a cross are suspended in the middle of the discharge by a fine fibre attached to the center of the cross, the spark produces no rotation of the cross. If, however, a vertical magnetic field is established in the gas, the cross rotates through a considerable angle. Professor Righi ascribes this rotation to the bending of the paths of the ions, or electrons, and to the additional protection which the vanes afford each other against impacts from one side rather than from the other in these circumstances. The observed rotations indicate that the effects of the positive ions are in general greater than those of the negative.

Novel Use of Electricity in a Restaurant.

An apparatus for the use of hotels and restaurants has been brought out in Wellington, New Zealand, which presents several novelties. At each table in the dining room there is a wooden frame containing the menu, and opposite the name of each dish there is a push-button. When a guest has made his choice he touches the appropriate push-button, which causes the number of the table and the numbers of the chosen dishes to appear in the kitchen upon an annunciator. The ringing of a bell also calls the attention of the cook to this order. An automatic printer at the same time makes a record of the order and a statement of the charge, which is received by the waiter when the dish is ready for serving. The remainder of the service is performed by the waiter in the customary way.

Street Lighting Contract at Mason City.

A contract has been closed at Mason City, Iowa, between the city and the People's Gas and Electric Company, for lighting the streets for nine years. The company is to furnish 110 arc lamps at $60 per year.

The Elementary Unit of Electricity.

In the issue of October 29, 1910, attention was called to the work of Robert A. Millikan, professor of physics in the University of Chicago, in demonstrating the existence of the elementary charge of electricity and the measurement of its value. Further research along this line, with refinements in the measurements and consideration of sources of error, have led to a revision of the value there given.

It has been found that some of the values used in this determination, such as that for the viscosity of air, were not known as accurately as had been supposed. Later determinations of some of these values, together with the corrections found necessary to the law of Stokes regarding the velocity of small particles falling freely in air, have enabled a final value to be assigned to the elementary unit of electricity.

At the meeting of the American Physical Society at Evanston, Ill., on November 30, Professor Millikan announced that this final value was 4.774×10^{-10} C. G. S. electrostatic units. This is believed to be correct to 0.2 per cent, as each of the elements entering into its computation is supposed to be known to an accuracy of 0.1 per cent.

Values in the same neighborhood have been obtained by other methods, such as experiments in radioactivity and the consideration of the magnetic properties of ferromagnetic materials, but none of the other methods of measurement are susceptible of such high accuracy as the method used by Professor Millikan, which was described in the issue above referred to.

The Peoria Electrical Show.

The second annual electrical show will be held at the Coliseum, Peoria, Ill., January 18 to 25. Leroy A. Mills, secretary of the show, states that some of the best features of the Boston and New York electrical expositions will be made use of at Peoria. A unique design for the exhibition booths has been decided upon. The Truswall Manufacturing Company, manufacturers of cement products, is under contract to furnish concrete pillars to be used as the corner posts of the booths.

A daily paper called the *Electric Show News* will be published. This will be printed on a press in operation at the show.

A rejuvenation of the Jovian Order will be held on the evening of January 23. Ralph W. Everson, of the Westinghouse Electric & Manufacturing Company, has been recommended as special statesman to have the rejuvenation in charge. The Illinois Electrical Contractors' Association will hold its annual sessions on January 24 and 25.

Electricity in Shoe Factories.

By H. O. Stewart.

Shoe factories require live steam throughout the year. The machinery is driven in groups at constant speed. This first fact entails the necessity of operating a boiler throughout the year. The second fact eliminates the desirability of individual or variable-speed drive. The central-station representative has found when such business is sought on a solely comparative cost-of-power basis, the margin is usually not of sufficient attractiveness to induce the factory manager to discard his engine and lineshaft drive or his electric power plant. A reduction of 25 per cent in the cost of power by the use of central-station service would be but a very small reduction in the cost of manufacture, as the average energy consumption per pair of shoes is one-third of a kilowatt-hour. At a rate of 3 cents per kilowatt-hour, the power would cost one cent per pair of shoes. The cost of a pair of shoes manufactured for $2 could be itemized as follows: power, 0.5 per cent; labor, 20 per cent; material, 40 per cent; all other charges, such as heating, overhead and fixed charges, etc., 39.5 per cent. The percentages vary somewhat in different factories.

A 25-per-cent decrease in the cost of power does not, as will be seen in the foregoing, materially reduce the cost of manufacture.

Fig. 1.—Group of Eyelet Machines Driven from Floor Below by Three-Horsepower Motor.

Advantages of Central-Station Service.

What interests the factory manager is a material decrease in the unit cost of production; or, in other words, an increase of output with present equipment and labor. The central-station industrial engineer's familiarity with factory conditions in general makes him particularly well fitted to analyze the processes of manufacture, and to recommend changes which will bring the business to the central station and at the same time materially reduce the unit cost of production. It should always be borne in mind that power should be used as a means of effecting economies, and that manufacturing should never be crippled by the exaggerated economy of power. Additional output is worth much more to the manufacturer than the average output, as it is obtained at the cost of practically material only.

As an example, consider a factory with an average yearly business of $500,000. By means of scientific methods, its output has been increased 10 per cent without additional equipment or labor. This additional output of $50,000 is obtained at practically the cost of the extra material, which is 40 per cent of this amount, or $20,000. The 10 per cent increased output brings a return of $30,000 profit for an in-

vestment of $20,000 in material. The manufacturer actually earns 150 per cent profit on this additional output, and only from 5 to 10 per cent on his average output. If the profit on his average output were 5 per cent, the 10 per cent increased output would more than double his average profit, his total profit being $55,000, while his average profit is but $25,000.

Increased output can almost always be obtained by improving the mechanical and physical conditions and details, and by keeping accurate and continuous records of each machine or, at least, of each group of machines.

Several minutes per day are wasted in the average factory by not beginning work promptly at the starting time, and by allowing the work to fall off gradually a half hour before closing time. An investigation of the above condition in one of the departments of a large factory indicated a possible increase of six per cent in the daily output. This additional output was partially obtained by having the motors up to speed before the whistle blew, and by a more rigid and careful supervision on the part of the foreman.

All machines should be run at their maximum economical speeds. It is sometimes the case that machines are actually running too fast for first-class work, but generally the opposite is true. The inherent defect in well-loaded private plants is that when there is the greatest demand for power to meet the increased factory output, the prime mover slows down somewhat. If lineshaft drive is employed, there is an additional loss of speed due to belt slippage. The machines, therefore, actually run slower at this time than when speed regulation is of less importance. The output of such a factory during busy seasons is, therefore, less than what it would be if all the machines were kept up to speed.

A careful study of the manufacturing processes often suggests a much better arrangement of the machinery. The proper machine layout means a minimum handling of material with the maximum facility for rapid work. It is often found that certain machines retard the entire factory output. Obsolete or worn out machines should be discarded and replaced by modern machines of ample capacity. The addition of a machine or an employee in a process which is limiting the factory output will generally increase the output. The substitution of modern machinery to perform those processes carried on by hand not only lowers the cost of production, but also increases the output. This is strikingly true of shoe machinery.

The output of a shoe factory is roughly proportional to the useful work delivered to each machine. A graphic wattmeter installed on the feeder to each motor-driven department will, therefore, furnish a continuous record, by means of which the variation in output, together with the causes, can be carefully watched. The general shape of the curve, frequency of the peaks and valleys, the broadness of the curve, all furnish valuable information.

In addition to the arrangement of machinery for the best possible routing of material, it should be remembered that good illumination increases the output and decreases the number of seconds. A clean, well-lighted, well-ventilated, properly heated factory invariably has a greater unit output than one of the opposite class.

Fig. 2.—Fitting Room. Motors on Ceiling of Floor Below.

Labor is such a large item in the cost of shoe manufacture that reliable power is paramount. There is no doubt but that the modern central station is better equipped and actually does give better service than an isolated plant. The central station's spare engines and boilers are ready to throw in in case of

Fig. 3.—Motors Driving Machines in Fitting Room Above.

trouble, and an organized body of trained operators meet quickly any emergency. These facts usually do not prevail in a private plant.

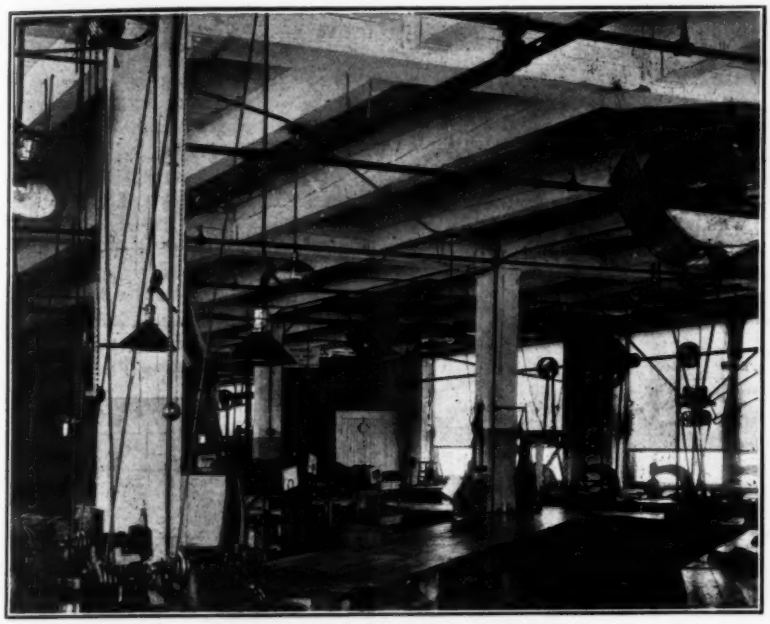


Fig. 4.—Group of Die-Cutting Machines.

A shutdown of any group of machines or department can be avoided by holding in reserve a motor of sufficient capacity to operate any department. This motor should be mounted on a truck and wired so that it can be quickly moved to any part of the factory, connected to the nearest panel box, and its pulley belted to the shafting.

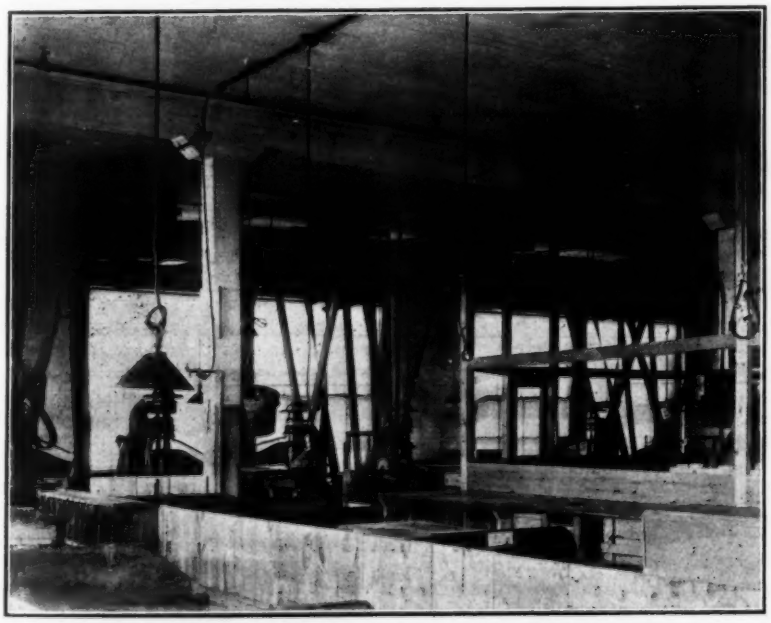


Fig. 5.—Six Die-Cutting Machines Driven by Three-Horsepower Motor.

Selection of Motors and Type of Drive.

Shoe manufacture requires a large number of machines, each taking a comparatively small amount of power, and operating at constant speed. The load on each machine fluctuates rapidly and at fairly regular periods. For these reasons, as well as for the fact that the machines themselves are naturally rather closely grouped together, group drive is, for the most part, generally used. On account of the diversity-factor among the machines, group drive permits of the use of a fewer number of motors of much less aggregate horsepower than could be obtained with individual drive.

The accompanying illustrations show very clearly the system of motor drive employed in some of the most modern and efficient shoe factories. It will be noticed that the motors are fastened to the ceiling, and that wherever possible the mechanical drive is located on the ceiling of the floor below the driven machines.

The elimination of numerous belts between overhead shafting and the machines makes a safer and cleaner installation, permits of better arrangement of machinery, and the most economical use of space. Fig. 2 shows a section of the fitting room of a large shoe factory. There are 350 machines in this department, all driven by 13 three-horsepower and 3 one-horsepower direct-current motors. The motors are located on the ceiling of the floor below, which is used as a stock room. The method of suspending the motors and protecting the stock from any oil or dirt which might drop from either the motors or the mechanical drive is very clearly shown in Fig. 3.

As the shafting operating the machines in the fitting department is located beneath the tables on which they are placed, the most compact and best type of drive is that of a motor placed on the floor and direct-connected to the shafting. Motors for use on either direct or alternating current, and running at from 400 to 500 revolutions per minute, are used to a considerable extent for this class of work.

The transportation of partly finished shoes from one group of machines to the next in order by means of power-driven belt conveyors will often be advantageous.

In order to remove the leather dust and surplus leather from those machines which shape the soles and heels, an exhauster system is used, which is similar to that found in woodworking plants. The hoods in these machines should be so designed and located that the cutting knives throw the leather refuse into the hood and in the direction of the suction pipe. In some factories one large centrally located exhaust fan takes care of the refuse of the entire factory. Usually, however, two or more exhausters are desirable. Small individual exhausters are used on those machines requiring a suction greater than that on the large exhausters, and also on those machines which cannot be conveniently piped to the main exhaust system. These small exhausters are usually driven from some rotating shaft on the machine itself. Sole-leather refuse is usually burned, although it can be sold to leatherboard manufacturers, along with leather scrap

from the cutting department where the uppers are cut out. The accompanying curve (Fig. 6) gives the approximate horsepower input to standard exhausters at different pressures.

The accompanying table gives the actual horsepower input required to operate each machine. The size motor needed to drive a group of these machines depends on the load-factor and the amount of shafting. The load-factor of the average group of machines will vary from 25 to 75 per cent, depending on the routing of material, ease of operation, and condition and general layout of the machines themselves.

Heating Requirements.

Even though most of the exhaust steam from a private plant is used for heating the factory during the winter, the chances of the central station obtaining the load on a strictly comparative cost basis are by no means slight. The factory must be heated on live steam 15 hours a day. But 75 per cent of the heat of the steam supplied to the average engine gets into the heating system. When operating on central-station power a small coal or gas boiler should be used to supply steam at the necessary pressure for steaming leather, heating wax and glue pots, and for the stitching machines requiring steam heat. A small automatic gas boiler located near those machines requiring steam can often be economically used. The heating boilers should be operated at low pressure to obtain maximum economy.

In addition to the usual equipment of electric flatirons, the modern shoe factory uses electrically heated wax and glue pots, and single and double shoe irons for shoe finishing. The temperature is accurately controlled with rheostats. Cleanliness, flexibility of use, safety, exact control of temperature, have all contributed toward the increasing popularity of these electrical devices.

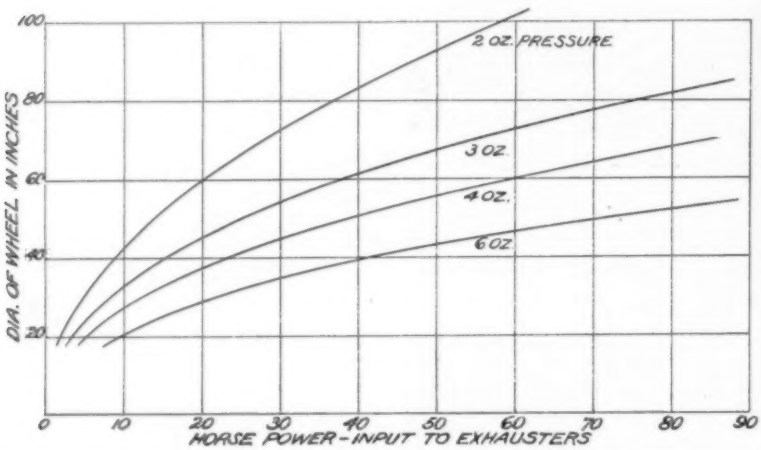


Fig. 6.—Actual Horsepower Input to Standard Exhaust Fans at Various Pressures.

Illumination.

The necessity for a very high grade of work on dark material makes first class illumination essential in the shoe industry. In a number of factories it has been found that good illumination costs about $2 per year per employee, and that poor illumination costs nearly as much. When the illumination is first class, the factory output is not noticeably decreased during dark days. It is unlikely that high-grade illumination would cost 25 per cent more than poor illumination; but even if it should, the damaging of one pair of shoes per employee per year on account of inferior lighting is much more costly than satisfactory illumination. As a matter of fact, poor illumination means low-efficiency lamps, worn out and inadequate reflectors, or none at all, and improper location of lamps. Experience proves that a scientific system of illumination can be installed which will supply from five to ten times the effective amount of light, and actually cost less to operate than an inadequate and poorly laid out installation.

On account of its superior color value, its high efficiency, and the numerous sizes in which it is now made, the tungsten lamp is the best known illuminant for this kind of manufacturing. Shoe manufacture requires general illumination of low intensity in those departments where machinery is used, and individual lighting on the machines themselves. The general illumination should have a fairly uniform intensity of two foot-candles on the working plane. The lamps should be placed near the ceiling, and should be equipped with proper reflectors in order to place the illumination where it is desired, and to protect the employees' eyes from the annoyance of brilliant light sources. The lamps should be so wired that those in the darkest part of the room can be turned on first, and those nearest the windows last. Most of the machines require an illumination of from 7 to 10 foot-candles. This intensity is most economically obtained by the use of low-candlepower tungsten lamps equipped with concentrating metallic reflectors. Ten-watt to 25-watt lamps, depending on the amount of light desired, should be used. In the case of sewing machines located in rows on tables, each lamp should be mounted on a piece of flexible conduit, so that the light can be directed to the point where it is most needed. The wiring should be located underneath the tables.

In the case of the other machines, the lamps can usually be fastened rigidly to the machine with clamps or brackets. Drop cords should not be used unless other means are impracticable. Both maintenance and annoyance are greater with drop cords than with conduit wiring coming up from the floor. Should the vibration of the machines cause an unreasonable amount of lamp breakage when using the 110-volt lamp, low-voltage lamps should be used, placing several in series if operated on direct current, and preferably using an autotransformer on alternating-current circuits. The finishing room should be equipped with general illumination of from 6 to 8 foot-candles intensity. The superiority of the color value of the tungsten lamp for work on tan leather is particularly noticeable in this department.

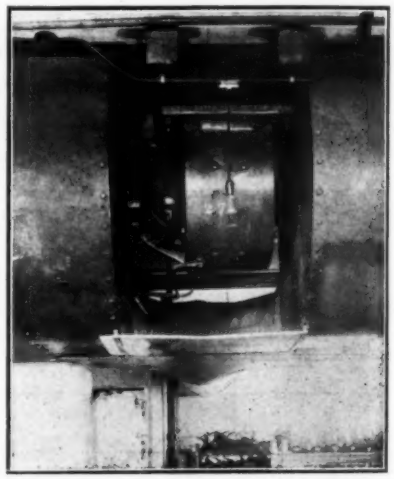


Fig. 7.—30-Horsepower Motor Driving Twin Exhauster.

Processes of Manufacture.

On account of its complexity and the unusually large number of operations involved, shoe manufacture is less understood by the engineering profession than any other line of manu-

facturing which is so extensively carried on. For this reason a somewhat detailed description of shoe manufacture, in so far as it is related to power utilization, is given.

In general, shoe factories buy their patterns and lasts from manufacturers who devote their entire effort to the manufacture of either one or the other. Shoe manufacture, then, usually commences in the cutting department, where the leather is cut into uppers, outsoles, insoles, and so forth; and the linings, stays, facings, trimmings, and so on, are cut out. These parts then go to the fitting department where they are assembled. The completed upper now goes to the lasting department, where the last is inserted and the insole and outsole are fastened to the upper. The shoe now goes to the finishing department, where the sole is smoothed, the heel put on, and the shoe finished.

The leather for the uppers comes into the cutting department in large pieces, tanned and ready for use. The cutter selects that part of the skin best suited for each part of the upper and cuts it out either by hand or by a power-operated die. The trimming cutter cuts out the linings, stays, facings, and so forth. These are of cloth, and when a power-driven die is used, a great many are cut at a time. These parts are properly marked, tied up in bundles, and sent to the fitting department.

The assembling of the upper takes place in the fitting department. When the edges of the leather are to be turned, they are first beveled or skived, then cemented, turned, and pressed into shape with the folding machine. Leather and linings are assembled by stitching and pasting. Some of the sewing machines sew two pieces of lining together and stay the seam up with tape at the same time.

Eyelets are now inserted in the uppers of the laced shoes by eyelet machines. Buttonholes are cut and sewed by automatic buttonhole machinery. Another machine sews the buttons on.

The completed upper is sent to the lasting department, where the last is first inserted, and then the counter and insole. The shoe is steamed slightly and then put on a lasting machine, which pulls the bottom edges of the upper over the bottom of the insole and fastens it with tacks. The surplus leather which has been folded over on the insole is removed and the edges beveled on an emery wheel.

The outsoles are cut from large sheets of heavy leather with power-operated dies. They are fastened to the insole, either by the Goodyear welt process, or by the McKay process. The former process consists in sewing a strip of leather about two-thirds of an inch wide around the insole near its outer edge. The insole is so channeled and turned that the welt is sewed to the turned edge without the stitches going through to the inner side of the insole. The space on the insole inside of the welt is now filled with cement and cork, felt, or leather. The shank is inserted and tacked in place. The outsole is now cemented and pressed onto the insole. The sole then goes through the rounding machine, which trims and channels it for stitching. The outsole is now stitched to the welt. The edge of the outsole which was channeled and turned up for stitching is now cemented, turned down, and pressed in place with a power press.

By the McKay process the welt is cemented to the outsole, the space on the insole inside of the welt filled as in the other process, the shank inserted, and the outsole cemented and fastened with a few tacks to the insole by use of a tacking machine. The sole is trimmed, channeled, and stitched, the stitches going through the insole, upper, welt, and outsole.

The shoe is now placed in a leveling machine, which shapes the sole and thoroughly irons it.

Heels are made up of a number of shaped layers of leatherboard cemented and nailed together. Holes are punched in the built-up heels with a pricking machine. A heeling machine places nails in these holes, drives them through the sole of the shoe and rivets them on the inside of the insole. The top lift of the heel is cemented and nailed on.

The shoe now goes to the finishing department, where the heels and soles are carefully trimmed and shaped with an edging machine. A breasting machine is used to shape the concave end of the heel. The bottoms are now sandpapered, blackened, and burnished; the uppers are cleaned, ironed, blackened, inspected, and the shoe is ready to be packed for shipment.

Horsepower Input to Shoe Machinery.

	Horsepower.		Horsepower.		Horsepower.
Goodyear rapid stitching machine.	0.4	Consolidated hand laster	0.5	Leveler	2.0
Atlas stitching machine	1.3	Lasting machine	0.3	Four-foot die press	2.0
Hercules stitching machine	0.8	Pulling-over machine	0.1	Sole trimmer	1.0 to 3.0
Automatic stitching machine	0.9	Adams sole cutter	2.0	Edge trimmer	1.0
McKay stitcher	0.2	Single sole molder	0.8	Edge pricker	0.1
Puritan stitcher	0.2	Counter molder	0.6	Single-edge setting machine	0.4
Sewing machines	0.1 to 0.2	Twin molder	0.8	Union twin-edge setting machine	0.4
Knox end splitter	0.6	Crimping machine	0.5	Eyelet machine	0.2
Stanley leather splitter	0.6	Clicking machine	0.1	Buttonhole machine	0.1
Amazon No. 7 skiving machine	0.3	Cementing machine	0.1	Lightning heel-nailing machine	2.0
Tip skiver	0.3	Beating-out machine	0.2	Mayo heel-nailing machine	2.5
Stiffening skiver	0.1	Sole-laying machine	1.5	Heel-trueing machine	0.3
Goodyear channeling machine	0.1	Slugging machine	0.5	Heel scourer	0.4
McKay channeling machine	0.1	Leather roller	0.2	Heel burnisher	0.3
Welt and turn machine	0.1	Staple-fastening machine	0.2	McKay heel trimmer	2.0
Fisher channel turner	0.1	Chicago wire fastener	0.3	Pricking machine	0.5
Goodyear channel turner	0.1	Knox beam dinker	0.2	Heel shaver	1.5
McKay leaf turner	0.1	Goodyear welt machine	0.4	Sandpaper machine	0.1
Tip turner	0.1	Welt beater	0.1	Buffing machine	0.2

Input to Electrical Heating Devices

	Watts.		Watts.		Watts.
Flatiron	500	Double shoe ironing tool	200	Glue and wax pots	100 to 300
Single shoe ironing tool	200	Shoe stamping machine	500		

Commercial Practice
Management, Rates, New Business

PUBLIC RELATIONS.[1]

By Harold Almert.

In few lines of industry is there a more insistent demand for large amounts of additional capital than that which comes from the electric light and power, gas and street railway companies. Thirty years old, the electric light and power business in this country represents not less than two billion dollars, or more than twice the money invested in the 100-year old gas industry, while the capital account of electric railways—younger still than electric lighting—is considerably more than the two first-mentioned combined.

Great as the physical property is that lies behind these bonds and stocks held very largely by the investing public, the work of development and construction is by no means finished, although the period of mechanical experimentation is already sometime closed. So rapid is the normal growth of the business of these corporations that the urgent necessity for physical expansion continues in increasing measure, and the financial markets are constantly called upon to supply the cash.

Owing to the enormous amount of capital invested in these projects by the public, which takes no active part in the management, it becomes the duty of those who are entrusted with the responsibilities to see that everything is done to make these funds (first) absolutely safe as to principal, and (second) yield a return commensurate with the commercial hazard.

One of the most important problems always before these men in responsibility is public relations. In the past it was considered unimportant; today it takes precedence over all other factors of public-utility management. The service furnished by public utilities, the rates charged, and the manner in which they conduct their business, vitally interest the public in the community served. The companies, also, are desirous of rendering the best possible service, charging reasonable rates, and conducting their business in an efficient and economical manner. Between the two,—the public on one hand and the utilities on the other,—there is a true community of interest. The relations between them, therefore, should be harmonious in every respect. In the past, however, this has not always been the case.

Controversies frequently have arisen from mutual misapprehension of the demands and requirements of the respective parties, and the effect of such controversies, often not conducted in a spirit of fair play and mutual respect, has worked untold hardships on public-utility companies. It has caused suspicion and ill-will among the immediate beneficiaries and has had the effect of retarding progress and constructive development of public-service enterprises in general. Both parties suffer largely from the strained relations existing under such circumstances.

One of the causes of these controversies has been the franchises passed in the early days by municipalities and accepted by the utilities. As conditions changed the public and the municipalities have sometimes failed to meet the companies in fairness, and have declined to sanction adjustments which every consideration of fairness and justness prompted. In other cases the companies have been at fault, have taken undue advantage of rights hastily granted to them, and have refused to accede to the reasonable requirements of the public, founded on changed circumstances and conditions surrounding the business.

In the end both parties desire the same conditions to prevail, I am sure; namely, a high grade of service, reasonable and compensatory rates, and efficiency and economy in operation.

In my judgment bitter controversies are wholly unnecessary. As a rule, neither the public nor the companies intend to be unfair or unreasonable. The situation requires, therefore, that a means be devised to bring about and maintain an amicable and friendly understanding between the companies and the public.

No one man, nor small group of men, can bring this about. Organized efforts, therefore, must be resorted to for the preservation of constructive and wholesale relations between the public and the companies. The manner of accomplishing this end is one of the highly important problems confronting alike the public and companies today.

Every active public utility is composed of two principal parts,—a "plant" and a "franchise." The streets and the alleys which the public utility has to use belong to the public. The latter, therefore, has the right to say how and to what extent they shall be used. The public contributes one of the prime essentials, namely, the franchise; the company provides the plant. As already stated, therefore, it follows that the company and the public are partners in the enterprise. On the one hand, they who invest the capital, time and energy expect compensation measured in dollars and cents. On the other hand, the public expects good and adequate service at fair rates. The rights of one should be equal to the other, and the interest of one should not be furthered to the detriment of the other.

The term "Public Utilities" itself implies being useful, and, therefore, of benefit to the public. To attain this the service must be competent.

Viewed from a business standpoint, the possession of a public-utility franchise should be looked upon as a trusteeship, to be administered in the interest not only of the company, but the public as well. To some, however, the possession of a public-utility franchise means only an opportunity for personal gain, but to the conscientious man such possession means an opportunity of administering to the public welfare.

With the uninformed the general idea prevails that anything connected with or appertaining to a franchise means "corruption." Most people believe that the possessor of a public-utility franchise at some time had been able to bring about a hypnotic influence over the city council; or, through the illegal use of money or otherwise, had on some dark night gotten the city council into such a frame of mind that they all willingly or unwillingly consented to the passage of a grant which gave to the grantee for one or more generations a hold upon every living soul in the community to such an extent that he could levy a tribute in any manner he might see fit, and from which the public had no recourse or appeal.

Limited-term franchises are wrong

[1] From a paper read at the banquet of the Electrical Credit Association of Chicago, November 22, 1912.

in principle. Take the condition in Iowa, for instance. In the course of court litigation it was brought out that the Statutes provided that the cities in that State can grant franchises to public utilities for a period of not exceeding 25 years. The Statutes also provide that the cities shall have the right to regulate rates, and, in fact, are required to do so, and when a city council has fixed a rate, it is not allowed to contract with a public utility that said rate shall remain in force for the remainder of the life of the franchise, or for five years, or for one year, or for any given length of time. City councils have the right to regulate the rates every day; they also have the right to take over the property and business of the utility at any time by condemnation. The Statutes do not define any basis of valuation. They do not state that it shall be on the basis of replacement value of the physical property, or the present value of the physical property, or on the basis of the value of the physical property plus the amount for the going value. Therefore, the utilities in that State are in constant danger should a hostile city council see fit to use its full powers to the detriment of the owners of the public utility.

Take another instance, that of a town slightly over 10,000 population. Fifteen years ago a franchise was granted to a utility company to supply water and electric light. Eastern capital was interested, and a plant adequate to supply both classes of service was constructed and put into operation. Five years ago one of the merchants in that city whose business was so organized that it required very little of his time, got into his head the idea that a competing electric plant would prove very profitable to him. He enlisted the interest of four or five of his influential friends and citizens, and they succeeded in getting the council to grant a competing electric franchise. They had intended putting in little or none of their own money, so they went to Chicago and New York and endeavored to interest capital, but did not succeed. However, owing to the publicity occasioned by the granting of the franchise, and claims which they had made, they were determined to carry out their plans, so they invested their own money, and, through their standing in the community, succeeded in getting a considerable portion of the old company's electric light customers.

As they learned more about the electric light business, they realized that the original company was making a small profit from its water department, but had not yet begun to earn any real profits from its electric light department, when depreciation and similar items were taken into consideration. The home, or second company, was unable to get sufficient income to pay all of its operating expenses, to say nothing of depreciation, and consequently ran behind a little every year. The owners concluded, finally, that the undertaking was a mistake, and that they had better sell out to the original company before depreciation got in too much work. It was then they made a sad discovery. They had not read their franchise carefully. There was a provision reading that under no circumstances should the second company sell out to the old company, or to any other company which might be organized in the future to serve that city. It also contained a provision that they could not buy the old company.

So there they are, losing money, giving an indifferent service necessarily at a high cost, due to duplicated systems, and the council refuses to permit a consolidation. The density of the business in that town is such that one company, conservatively capitalized, with a well constructed system and an able efficient management, can earn a fair return on the necessary investment, but that is all. Who is to blame and who is going to pay for the cost of learning that this business to be properly conducted must be conducted as a monopoly?

In fixing rates we are told that state public-utility commissions will protect the investor as well as the consumer. Some of the present commissions, recently formed and lacking in experience, in their statements setting forth what they will and will not consider as a basis for fixing rates, among other things, say, there shall be a valuation of the physical property, and emphatically declare that nothing shall be allowed in the inventory of physical property for the purpose of fixing rates, which is not at present being used and is at present useful for the purpose of producing and distributing the products of that utility.

In other words, according to this rule, if your present equipment becomes inadequate so that you cannot properly serve your customers, you must not discard it and put in larger and more efficient apparatus. If your present generating units are adequate, but, due to advance in the art, you can discard them and install more modern, more efficient, and more reliable units of the same size, and which will enable you to render a higher class of service to your customers—that is to say, if your equipment is obsolete—you must still continue to use it until it is worn out and you have had a chance to earn enough from it so that you will have had ample opportunity to write it off from your investment account.

Why? Because if we, the public-service commission, find that you, the public-service company, in your judgment, and in the effort to render an up-to-date service, to keep abreast with the improvements in the art, and to adequately serve your community, discarded some of your equipment by actually removing it to make place for more useful, more efficient, more reliable equipment, so that on visiting your property we do not find the old apparatus actually in place, and that it is being used and is indeed useful for rendering service (even though you have not had an opportunity to use and earn from it sufficient to charge it off your capital account), we, the commission, will allow you nothing in our inventory of what from now on we will consider as investment for the purpose of arriving at what we consider equitable rates. You should have foreseen the advance in the art and the growth of the business, and charged your customers rates high enough so that you would have earned a fair return on your investment, plus enough to write that investment off your books, when you discarded the equipment, or, if the traffic would not bear such rates, you should have made the public you serve be content, and continue to use the equipment until you can earn a fair return, plus an amount sufficient to write it off, because we, the commission, are only interested in what you have, and if the money which you have collected from the public in the past has not been sufficient to pay you back the principal, plus a fair return on equipment which you have discarded, due to inadequacy, obsolescence, municipal requirement, or public demand, that is your loss, Mr. Investor, as we are concerned only with the present and the future. Is that fair? Does that tend to establish proper relations between the public and the public-utility corporation?

I am interested in the case of a client which is before a public-service commission at the present time, where the public-service corporation, in its effort to give adequate and reliable service, discarded over a million dollars' worth of steam-driven generating apparatus and distribution equipment to enable it to adapt itself to receive transmitted hydroelectric power which the citizens, through their common council, chamber of commerce and the newspapers, were clamoring for. Now, the fairness of the company's rates are being investigated by a state commission which uses, among other things, for the basis of arriving at future rates, an inventory and appraisal of the physical property (considering the present or depreciated value instead of

replacement value), and allows in that inventory only such items as are now being used and are useful for rendering service at the present time.

Much of the apparatus referred to was being used and was, indeed, useful until the company yielded to the clamor for transmitted hydroelectric power, when it suddenly became useless and needless, even as a reserve, owing to the reliability of the transmitted power.

The company removed and sold what apparatus it could, and reduced its investment account by the amount of the salvage received. Most of the balance, however, still stands charged to "Plant Investment," as it has only been in the last few years that the company has earned a sum sufficient to pay operating expenses, interest, and enough additional to charge off about one-half of the required amount for depreciation after paying dividends, that have not exceeded the legal rate of interest for that state, and the company is not over-capitalized.

We are told that the public-service commission will protect the investor and the consumer alike. If this statement is true, the public-service corporation just referred to has nothing to fear, but if past utterances, as read from some of the recent commission decisions in that state, are an indication of what will be decided in this case, then the public, which this corporation serves, will, in the near future, through its representative, the commission, try to confiscate, take away from this corporation (composed of hundreds of innocent investors), over a million dollars, without due compensation, which is wrong, which is unconstitutional, and which should not be in a land where we hear so much about a square-deal policy.

I am not an alarmist nor a pessimist, and therefore believe that the court of last resort will see that justice is done; but think of the cost in time and money that will be wasted unnecessarily if this has to be resorted to, as it probably will.

The commissions, I believe, mean to be fair, and, when they have had sufficient experience, will be, but in gaining this experience unnecessary hardships may be imposed on the companies investigated by them in the meantime.

I say that it should be the duty of every commission to look backward as well as forward, and the investigation should be of the most searching character. If the records of the past are not clear, and if they have not been altered or destroyed purposely, then the company should be given the benefit of the doubt, if there is any doubt existing.

I could cite a dozen instances such as the foregoing, but simply cite these to show that first of all, before proper public relations can exist, the public utility must have a satisfactory franchise under the provisions of which, if it renders good service at reasonable rates, it will be permitted to live and be protected against competition.

It is my judgment, therefore, that we should get away from limited-term and competing franchises, and substitute indeterminate franchises amply protecting customers and company, and these granted by a power higher than that of the municipality, which is apt to be, and in fact frequently is, subject to local prejudices; in other words, a franchise or permit from a state commission, assented to by the community concerned, which will permit the company to continue in business and be protected from competition so long as it renders adequate service at reasonable prices, and treats its customers fairly. When it fails to do so, either willingly or through inability, then such a commission can and should offer the opportunity to another company that can and will serve the community as it should, providing the new company takes over the property and business of the old company at a fair value.

In order to render good service a public utility should be protected against ill advised and poorly considered legislation. Often laws calculated as reforms turn out to be burdensome to the public and to the utility alike. In certain communities a tendency exists to levy taxes of inequitable severity upon utility companies. Excessive taxation of this kind logically promotes higher rates for service than would otherwise be necessary. The result of this unequal taxation is that the tax burden is shifted inevitably from the property owner to the user of utility service, and as a result the company is unable to reduce rates or extend service to new and thinly settled districts, which it would otherwise do.

Experience has proven, without the slightest shadow of doubt, as I have already stated, that for economic reasons electric light, gas, telephone and street railway utilities should be operated as protected and regulated monopolies.

The appropriate regulation for the protection of the public as to the adequacy and price of service will, as I have already stated, come from a thoroughly organized and competent state commission. When these conditions prevail (and they should, very shortly, in every state), the greatest differences between the public and its utilities will have been overcome.

Interesting Window Displays.

Four succulent turkeys, first electrocuted and then baked to juicy tenderness in an electric oven, were contributed by the Kentucky Electric Company, of Louisville, Ky., to the Newsboys' Home in that city on Thanksgiving. An unusually attractive window display featured the passage of Turkey Day at the "Ky-El-Co." headquarters on Fourth Avenue, and thousands of passers-by stopped to gaze at the bountiful spread of roast turkey and cranberry sauce which was exhibited, flanked by a host of delicacies, all electrically prepared. The display was changed several times in order to keep it perfectly fresh, and every time a new consignment went in, the hustlers over at the Newsboy's Home rejoiced. The electrical laundry window display of the Ky-El-Co attracted so much attention that it was kept up for two weeks instead of only one, as was originally intended.

Ornamental Lighting for Denver.

There is a movement on foot in Denver, Colo., instigated by the business men whose places face Champa Street, to have that thoroughfare one of the most artistic and brilliantly lighted streets of any in Denver. The proposed lighting will extend from the new postoffice on Eighteenth Street to the Auditorium, on Fourteenth Street. The business men are co-operating with the city in an endeavor to have it share half the expense of buying and erecting the poles.

It is planned to have a system of lighting similar to that used in Los Angeles. At frequent intervals along the entire distance large clusters of lamps mounted on standards of artistic design will be erected. Each standard will be capped by a cluster of four lamps, with a fifth on top.

New Byllesby Acquisition in Louisville.

The George G. Fetter Lighting & Heating Company, of Louisville, Ky., a public-service corporation recently acquired by the Byllesby interests of Chicago, has commenced furnishing central-station steam heating service. The Keller and Columbia buildings, large office structures in the neighborhood of the Fetter plant at Bullitt and Main Streets, have been connected for this service. The formal election of officers in the Fetter company recently resulted as follows: president, George H. Harries; vice-president, Herbert L. Harries; general superintendent, J. Hoadley Cochran. General Harries is president of the Louisville Lighting Company. Mr. Cochran continues in a position he has held for some time.

THE ECONOMY OF CORPORATIONS.[1]

By John Otto.[2]

Down at the root of the things which make for the economic management of our public-service corporations and giving them one of their greatest advantages over municipal enterprises is their ability to purchase material for construction, maintenance and operation more cheaply than the same commodities can be purchased by untrained and short-termed political office seekers. Ask the bonding companies for the percentage of corporation purchasing agents who have been delinquent in their accounts, or have accepted money or its equivalent, with whom they have had dealings, and they will tell you that the total of dishonest buyers for corporations is but a small percentage of the whole.

The purchasing agent of the corporation usually begins his career in minor positions of his employer and by the slow processes of loyalty, honesty, integrity, and ability which result in recognition, reaches a point where his employer is willing and warranted in entrusting him with the purchasing of millions of dollars' worth of material and in relying absolutely upon his judgment.

Among the duties of the purchasing agent is to be reasonably familiar with every class of material which is required by his company, relying upon the opinion and recommendations of the engineers as to technicalities. This is an undertaking which requires constant vigilance with a company where ramifications of its purchases reach into the millions. With the Southern California Edison Company, purchases during the year amount to upwards of two and one-half millions of dollars, of which $1,750,000 are electric.

A purchasing agent for a company of this size and character must, to a certain extent, have a general knowledge of all the material in the market which he has occasion to buy. He should know, for instance, the product of timber, wire and cables, poles, crossarms, transformers, meters, etc.

It is necessary for the purchasing agent to know the trend of the market on copper and its products, thus making it necessary for him to keep in touch with the market quotations on the raw material, also to keep himself advised as to the output of the mines and the total consumption of the finished product and the amount of raw material carried in the market. To illustrate, we purchased in November, 1911, two million pounds of No. 4/0 stranded copper wire at approximately $14.25, whereas at the present time we should have to pay about $18.25. About the same time this order was placed several other orders were placed in this country and in Europe for like amounts, which, coming as they did when the copper market had been quiet, caused by inactivity in the electrical industry, at once caused prices to advance.

In the placing of orders price does not always govern, as quality is the first thing to be considered. The second matter of importance is delivery. For instance, if an important extension had been passed upon and the operating department had been instructed to see that this work be started and finished at the earliest possible date in order to enable us to take on a very attractive piece of business, we should be largely swayed in the placing of orders for the necessary material by the delivery we could secure. We might receive a quotation from some eastern concern where the price would be, say, $100 less than we could purchase the same material for in the local market, but it might not be advisable to take advantage of the eastern price for the reason that the amount involved would be so small as compared with the revenue to the company and the good will the consumers would have for us by virtue of our promptness in serving them.

On the other hand, the purchasing agent of the municipal plant might be governed more or less by henchmen or political influences, and it could hardly be expected of him to show the same interest as one associated with a corporation where the officials and department heads work in unison and harmony for the upbuilding and solidity of the company of which they consider themselves a part. If this spirit did not obtain it would seem to me impossible to build up the very large interests that are so numerous in this country, which all demonstrates beyond a doubt that where these influences are so prominent success will of necessity be the result.

Finally, a purchasing agent, to achieve the best results, must adhere to strict business principles. His duty and conscience should be clear and as far as is compatible with the ramifications of his particular company his every action untrammeled, in order that the highest efficiency may be obtained.

1 From *Edison Current Topics*
2 Purchasing agent of Southern California Edison Company.

Central-Station Service for Hotels.

The Louisville Lighting Company, of Louisville, Ky., recently contracted to provide current for manifold purposes in the new St. James Hotel in that city, a $250,000 hostelry to be erected by J. J. Gaffney, on Walnut Street, between Second and Third Avenues. This award puts the Louisville Lighting Company in possession of a number of valuable hotel contracts, including the one for supplying the Henry Watterson Hotel with power and light and one for emergency service with the Galt House.

Christmas Electric Appliance Sale.

All of the Byllesby electric properties in co-operation with local electrical supply dealers will have special household electric appliance campaigns during December. Devices such as electric flatirons, toasters, portable lamps, coffee percolators, grills, small stoves, washing machines, vacuum cleaners, curling irons, etc., make acceptable Christmas gifts, and the public has approved the idea since the electrical interests got behind it a few years ago. There are several devices such as electric chafing dishes, which have 90 per cent of their annual sales confined to the holiday season. Unprecedented results marked the electrical appliance sales a year ago, and in many towns more than twice as many articles were sold for gifts than ever before. This year the methods being put forth by the manufacturers, dealers and central stations are unusually vigorous, and in most cases last year's records will be bettered 100 per cent. Manufacturers have many new and attractive household appliances this year which will appeal to the Christmas shopper. The Byllesby properties will join with other central stations in seeking to enlist the co-operation of the local press toward reducing the accidents from the Christmas tree candle, by the substitution of electric Christmas-tree lighting outfits.

Central-Station Exhibition at Fair Made Profitable.

R. E. Flower, manager of the new-business department of the Mobile (Ala.) Electric Company, a Byllesby property, tells in a letter dated November 23 how the exhibit of a central-station company at a fair can be made to pay for itself through profit from sale of electrical appliances. The Mobile and Gulf Coast Tropical Fair closed November 17 after a very successful week. Contrary to previous years, the Mobile Electric Company concentrated effort upon the display and sale of electric flatirons. During five days 162 irons were sold and paid for. Although the irons were sold at 50 cents less than the ordinary retail price, the transactions yielded a net profit of $54.69 over and above all expenses. The exhibit of the electric company was combined with that of the Kenny Coffee Company and emphasis was given to flatirons by a special display on each side of the company's general exhibit.

Electrical Construction

FIRE ALARM SYSTEMS.—V.

Notes on the System of the City of Chicago.—II.

The method of handling alarms of fire in the Chicago plant under ordinary conditions has already been outlined. Before leaving this part of the subject, however, it will be well to speak of the usual method of directing the movements of fire companies when fires too severe to be handled in the ordinary way occur.

The first alarm of a fire always calls certain of the companies in the district to the scene of it. In case the officer in charge of these finds that other companies are needed, he brings them to the fire by sending in what is known as a "two-eleven" alarm from the nearest signal box, the alarm being sent by means of the key in the box circuit. If after the arrival of these additional companies, it is seen that still more help is necessary, a "three-eleven" alarm is turned in, and to this all the remaining companies of the district promptly respond. When the fire happens to be very serious, it may be desirable to call at once both those companies which would ordinarily respond to a second alarm and also those which would usually wait for the third alarm. Such a call is made by means of a "four-eleven" signal from the street box.

Whenever a fire is so serious as to require the presence of all the companies in the district, the chief of the fire department or a representative of his goes to the central office of the fire-alarm system, and from this point he directs companies from other districts to move into the engine houses which have been made vacant. As he signals companies to move he uses the map of the city shown in Fig. 6 to keep track of their movements. This map, the dimensions of which can be easily estimated from the photograph, has the location of every engine house in the city marked on it by means of a small circular, semi-transparent disk fixed in a circular opening of the same size in the map itself. On each of these disks is the number of the company the location of whose headquarters it marks, and behind it is a small electric lamp, the burning of which makes the disk luminous. A separate switch loop for each one of these lamps runs to the plug board seen on the table just in front of the map, and here every lamp has its own receptacle and plug, both properly numbered. When an engine house becomes vacant, the man in charge of the map makes a memorandum of this by removing the plug switch so as to extinguish the light behind the disk which indicates the position of the house; and as soon as another company reports at this house the disk is lighted up again. A dark disk means that there is no company on duty at the house whose number it bears.

Fig. 6.—Diagram for Following Movements of Fire Companies.

Thus, on occasions like the one mentioned, the man in charge at the central office has always before him a diagram by means of which he can see at a glance how the fire companies are distributed over the city, and can also follow the movements of companies as they leave their headquarters to go to the fire or to the headquarters of some other company.

Fig. 7 is a photograph of the standard equipment for receiving alarms at an engine house and for sending signals from here to the central office. What this equipment consists of has been stated already, except that it was not mentioned that a telephone stand is included here and that there are plug connections for opening either joker or sub-joker lines and also for grounding either side of either one of these circuits.

A fireman is kept on duty near this table all the time. When an alarm comes in, he can call any firemen not in this part of the building by means of a bell controlled with a push-button switch.

Projecting upward through the floor under the table shown in Fig. 7 there is a trip by means of which the doors of all the stables are opened and the horses left free to move to their places at the apparatus.

Connections to Joker Lines.

In the first paper on the Chicago fire-alarm system the connections at the central office for the signal-box circuits

were explained. Fig. 10 shows the switchboard connections of the joker circuits. The connections to the sub-joker circuits, sometimes called the alarm circuits, are not included in the figure. It is hardly necessary to repeat that these two classes of lines are the ones over which alarms coming from a street box are transmitted to the various companies of the fire department.

As in the case of the signal circuits, current for these circuits is supplied from small dynamotor units, and each outgoing line is protected from excessive current by automatic oil switches. The overload relays are shown at the top of the figure, as are also the keys for tripping the breakers manually and for restoring the switch after the circuit has been opened. The voltmeter shown is used to test the lines for grounds, single-pole, double-throw switches being connected to one terminal of the instrument so that either side of any circuit may be tested at will. Above these in the figure are the switches for making grounds on the lines whenever it is desired to make them. It will be recalled that there are similar provisions for testing for grounds and for making grounds at the central office on all signal-box lines. Sensitive ammeters are employed for keeping a constant check on the current strength in the various circuits, and there is a rheostat in every circuit for keeping the current within the desired limits. There is a small signal lamp *L* in every joker circuit, and also a linolite lamp whose function is similar to that of the linolite lamps in the signal circuits. It will be noted that each circuit contains a telegraph sounder, too, the sounders being marked *SDR* in the figure. The circuit "To Striking Position" connects with the key by means of which the operator sends signals to the engine companies. The master key shown in the left side of the diagram is the one the operator employs to notify all the other companies of the fire department when a given company has returned to its headquarters from a fire. The returning company's sounder in the office is cut out by depressing one of the cutout keys during this notification.

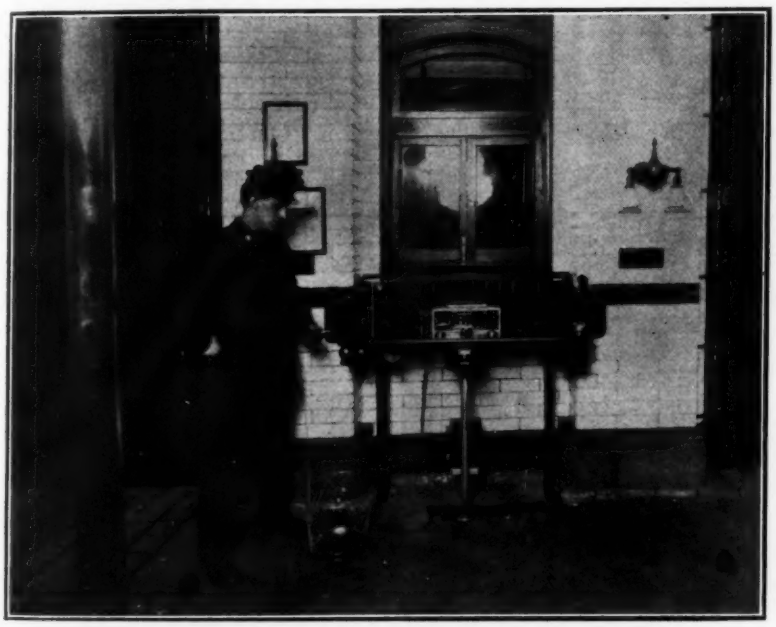


Fig. 7.—Equipment for Receiving Alarms at Engine House.

Maintenance of System.

In the case of any fire alarm system for the protection of a city it is of the utmost importance that there be ample provisions for the prompt detection of faults whenever these occur and for their speedy removal. The ease with which troubles may be discovered and approximately located depends in a large measure upon the design of the system; the promptness with which they are remedied is determined by the proficiency of the repair service. It will be seen in the following discussion how faults are discovered in the Chicago installation, but before this matter is taken up a word concerning the equipment of the fire-alarm bureau for making repairs may be in order.

This equipment includes a large and conveniently located shop in charge of mechanics trained to make repairs on such apparatus as they are liable to be called upon to make, or, for that matter, to construct new apparatus. The men who take care of repairs on the outside lines of the system are known in the department as repairers. There are 30 of these and 13 assistant repairers. The headquarters of the repairers and their assistants are in fire-department engine houses, each repairer and his assistant being assigned to their own particular district. Besides these men there are linemen, cable splicers, and so on who can be called into service wherever they are needed. Two of the repairers have automobiles and the others horses and buggies. Thus a repairer is equipped for moving over his district promptly with such instruments and tools as he is likely to need in ordinary cases of line trouble. He is subject to call from the operator on duty at the central office any hour day or night, and is required to respond without delay.

It would be impracticable, of course, to attempt to enumerate all the difficulties that a repairer on so large a system as that under consideration may encounter and to undertake to tell how they are overcome. Men in charge of work so important as this should be men of thorough training, and should be men who can be depended upon to exercise patience and ingenuity whenever troubles of an unusual nature arise. However, the best methods of handling the commoner troubles can be made clear in a paper like this, and it is believed that the results of such a procedure will be worth the effort. The means of locating a break in a street signal-box circuit will be considered first.

It is understood already, no doubt, that in the Chicago fire-alarm installation all signal-box, joker and sub-joker lines are closed circuits; that, is, circuits in which the current flows continuously except while an alarm or other signal is being transmitted over the conductors. Whenever an accidental break occurs in a signal-box circuit, the resulting interruption of the current causes the release of the armature of the telegraph relay in the central office which happens to be in this particular signal line, and thus the local alarm bell and the linolite lamp mentioned in the preceding article are cut into circuit. The ringing of the bell attracts the attention of the operator, while the lighting up of the lamp indicates what circuit is open. Since the bell does not begin sounding the number of a street box nor the signals which a repairer might send in from a box, the operator has no difficulty in deciding what caused it to ring.

As soon as the operator has noted a break in a line, he calls the proper repairer over the telephone which is a part of the fire-alarm system, and the latter starts out at once in search of the trouble. He goes to a street box in the neighborhood in which he suspects the break to have occurred, and

in the meantime the operator tests the line at the central office for grounds. In case it tests free on both sides of the circuit, he grounds one side and leaves the ground on while waiting for a signal from the repairer. As was shown in a preceding article of this series, most modern types of signal boxes are arranged so that the circuit may be grounded by the insertion of a plug in a receptacle in the box provided for this purpose. In hunting for the break in the line the repairer establishes a ground at the signal-box and tests to see whether he can call the operator at the central office or not. From a consideration of Fig. 8, leaving out of account for the moment the ground shown at G_1, it is clear that if the operator has grounded the line at G and the repairer has connected it to ground so as to place the alarm mechanism of signal box B between ground and R in the central office, it will be possible to signal from box B to the central office although the circuit is open at some such location as that of the break shown between boxes B and D. The path of the current would be from R through signal box B and over to the return side of the circuit through the ground. Every repairer, as well as all operators, is required to be sufficiently familiar with the Morse telegraphic code to send or receive 12 words per minute, and in the making of tests like the one under consideration this code is employed to exchange signals between the operator and the repairer, the former using the key in the central office and the latter that in the signal box. It should be explained, also, that on the Chicago lines, the polarity of all signal boxes is the same, the current entering the box always at that binding post which is at the left of an observer standing in front of it and facing it. When the repairer has established communication with the operator and has learned that the ground G at the central office is on the left side of the line, he moves his ground from one box to another in the direction of box D, repeating the tests at each successive box, and by noting the last box at which communication was possible and the first one at which it becomes impossible it is found between which two boxes the open circuit is located. Knowing the order in which the boxes are placed in the line, the repairer can easily tell from their numbers which direction he is moving along the circuit.

When a break has been definitely located between two boxes, it can be kept bridged by grounding the two boxes nearest it until the fault can be removed.

It sometimes happens that when an accidental break occurs in a signal circuit it is found that there is already a ground on the line at some such point as G_1 for example. In such a case the repairer may prefer to test out the trouble with both wires clear at R and L, in the central office. The method of procedure should be clear enough, in view of what has already been said, from a study of Fig. 8.

When a repairer wishes to test nearer a break in a conductor than the nearest signal box, he can do so by putting in circuit at the desired point a key similar to the one in the box, this being a part of every repairer's outfit.

In the central office of the Chicago system all circuits are given frequent voltmeter tests to see whether serious grounds exist on them, and as soon as any considerable ground has been discovered a repairer is called out to remove it. A simple method of locating grounds consists in holding the line open at one signal box after another while the operator tests first one side and then the other. It is obvious that one side of the circuit will test free during such a process. By noting which side this is the operator is able to instruct the repairer as to which direction along the circuit he should move in order to reach the fault.

From Fig. 9 it is seen that another practicable way to locate a ground is for the repairer to try calling central from various boxes along the line while the operator keeps one side of the circuit grounded there. For example, if the central office ground is made on the left side of the circuit, at G_2, and the accidental ground is at G_3, the repairer will probably not be able to call the operator except from boxes located between G_3 and R. Knowing that the office ground is on the left side of the circuit, the repairer can thus be sure that as long as he can signal central he must keep moving further away along the right side in order to come closer to the accidental ground.

Another possible source of line trouble besides those already mentioned is that arising from physical contact between the fire alarm circuit and some high-tension wire in the local lighting and power circuits. When such contact occurs the high-tension wire is quite liable to ground through the fire-alarm system and the circuit-breakers at the central office will usually open. All repairers and their assistants are furnished rubber gloves and boots to be worn as a protection against shock in removing faults due to contact with high-tension wires.

The foregoing remarks concerning the location of line troubles have been confined to signal-box lines, but it should be noted that the procedure is practically the same where the fault whose location is sought is in a joker or a sub-joker line. When these are being tested out, the repairer uses the engine-house equipment instead of the signal box for opening the line, making temporary grounds, calling the operator, and so on.

Contemplated Changes in System.

Although the Chicago fire-alarm installation is giving good service, there are a number of changes the making of which would unquestionably improve the system. In fact, it is the aim of the department of electricity of the city to make these changes as fast as the money for the purpose becomes available. Some of the signal-box circuits, for instance, are badly overloaded, there being as many as 60 boxes or one line in a few cases. It is intended to add to the number of signal circuits and put part of the boxes from the overloaded lines on the ones added as soon as this can be done. If present plans are not interfered with, the arrangement will finally be such that no signal line will contain more than about 35 boxes.

The department of electricity is also planning to interlace the street signaling boxes as far as practicable. For example, where there are two signal circuits in the same street one box will be placed in one circuit and the next adjacent box in the other, and so on throughout the sections where the two lines are near each other. In any city, such an arrangement of boxes as this is to be recommended for all localities where it can be made. It is an extra assurance of freedom from interruption in the service which is generally well worth the effort and expense necessary to secure it. This sort of construction makes it practically certain that no neighborhood along the interlaced lines will ever be even temporarily without the protection of a fire-alarm box in good operating condition, for the chances that both of the two interlaced lines will be out of order at the same time are exceedingly remote.

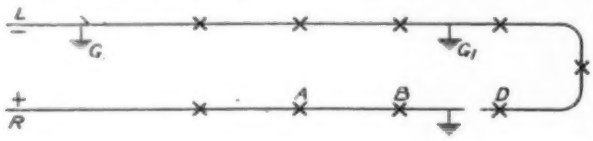


Fig. 8.—Connection for Testing for Open Circuit.

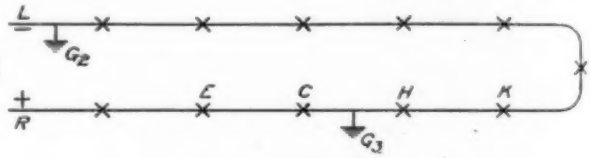


Fig. 9.—Grounded Circuit.

A still further important improvement which has already been begun in the Chicago system is the painting of the street signaling boxes so as to make them so conspicuous that they may always be found readily by any person wanting to turn in an alarm of fire. Of the 2,000 street boxes in the city 500 have been painted a bright red color, and where the boxes are mounted on the tops of iron posts or pedestals the pedestals have also been painted the same color. Boxes thus painted can be seen for blocks; and, moreover, the color itself is an effective suggestion of the

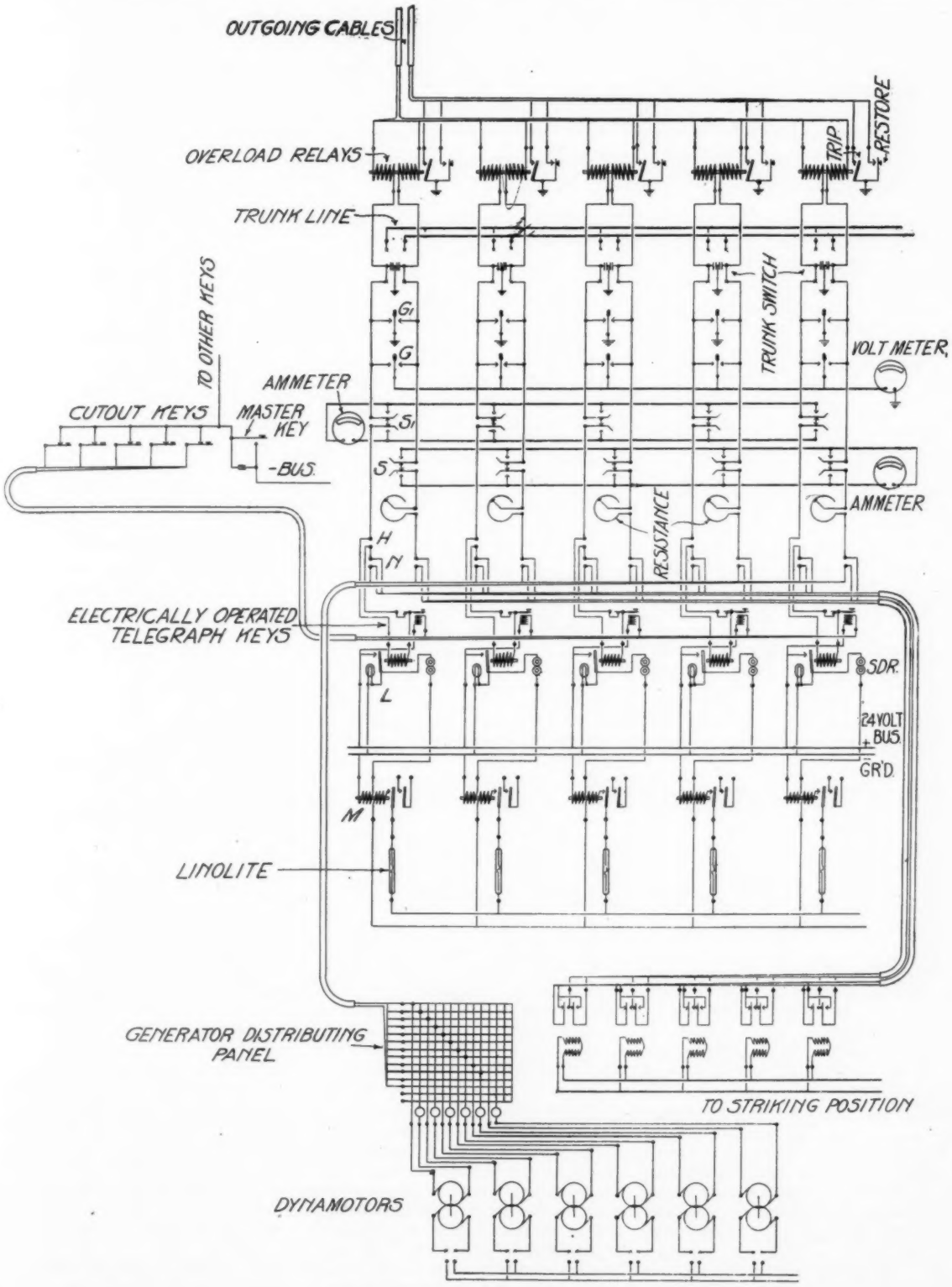


Fig. 10.—Connections to Joker Lines.

character or use of the box. It is planned to paint all the other boxes in the city as soon as possible. It may be appropriately remarked in passing, that this practice would seem to be well worth the consideration of any city having a fire-alarm system, however small the city might be. It is a safe assertion that money spent in painting street boxes this way, and in re-painting them as often as they need it, will generally be found a wise investment.

The department of electricity of the city has also recommended the substitution of keyless doors on all fire boxes now having outside doors locked by means of keys.

Conduit Construction.

It is very evident that the tendency of the times on the part of architects, engineers, inspection departments and municipal authorities is toward the requiring of metallic conduit for the installation of wires in buildings. Recognizing this tendency the National Electrical Contractors' Association, through its Executive Committee, has been working on the preparation of reliable data in regard to the proper size of conduit to be used in installing wires and cables.

The disposition in the past has been to use conduits of too small interior diameter, and in the preparation of these charts care has been taken to recommend conduits of sufficient size to cover all their conditions, at the same time having in mind that the economy in installation should be considered and extravagant sizes in conduits not recommended.

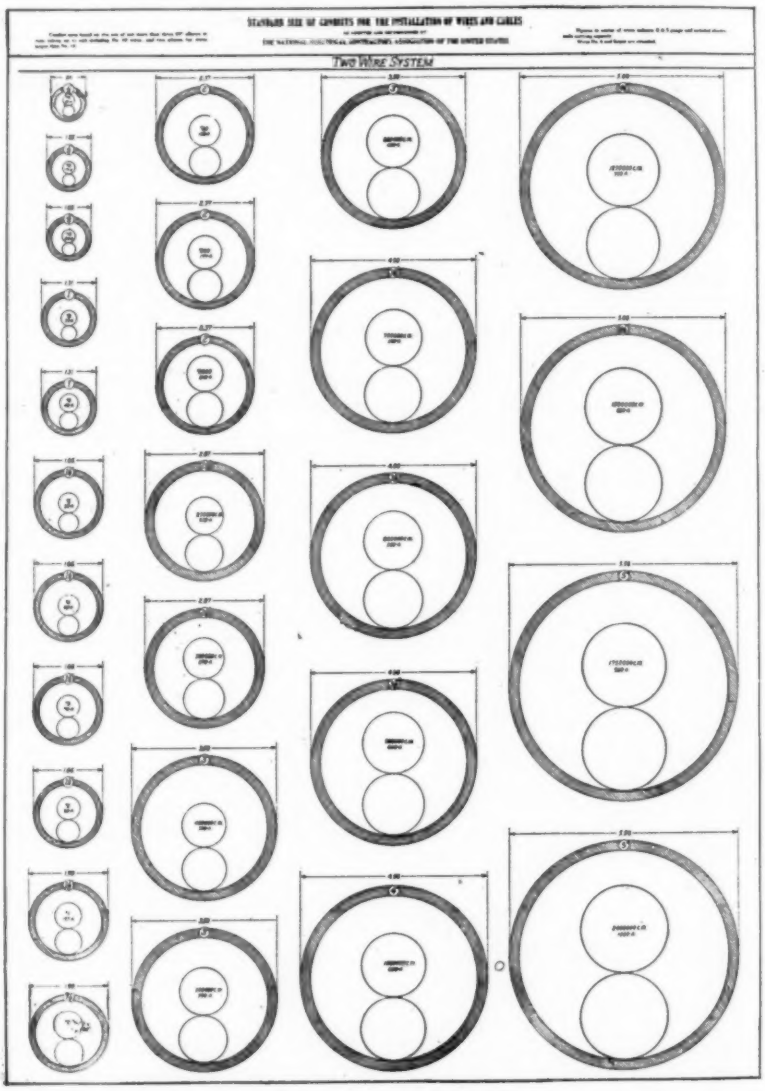
Very nearly a year has been spent in the study and investigation of this subject, and this has resulted in the preparation of charts showing in full size the proper-sized conduits to be used for installation of various combinations of wires and cables, and these charts were officially adopted at the Twelfth Annual Meeting of the National Electrical Contractors' Association.

The charts show the conduit and conductors in full size, and the form of the chart is shown by the accompanying illustration, which is reduced somewhat over two-thirds. The prints are made from plates, and the sheets are mounted on heavy board with an eyelet at the top for convenient hanging.

In addition to showing the size of conduit needed for each combination of wires, the charts give the actual external diameter of the conduit, and the carrying capacity of the wires shown.

The complete set comprises six charts, and shows the proper size of conduit for one, two, three, four and convertible three-wire systems; combinations of duplex wires in sizes Nos. 10, 12 and 14 B. & S. gauge; single-wire combinations of No. 14 B. & S. wire up to 90 wires; combinations of No. 16 and No. 18 B. & S. fixture wires up to 150 wires, and combinations of telephone wires up to 50 pairs.

This covers practically all of the data required for the installation of wires and conduits, and presents it in a form most convenient for use.



Sizes of Conduits and Conductors.

The advantage of a standard system is self-evident from the standpoint of the architect, engineer and contractor, and it is the hope of the National Electrical Contractors' Association that those having to do with the installation of conduits will accept the charts as prepared and write into their specifications that "the sizes of all conduits shall be the N. E. C. A. standard."

The National Electrical Contractors' Association has borne the work and expense of the preparation of these charts and in the interest of standardization is prepared to furnish these charts at the actual cost of producing them, and will forward a set, securely boxed, f. o. b. Utica, on receipt of $2.25.

The actual saving in time from the use of these charts will make them almost invaluable to the contractor, engineer and architect, and orders for them or requests for further information should be sent to W. H. Morton, secretary, 41 Martin Building, Utica, N. Y.

Oregon Association.

The officers of the new Oregon Electrical Contractors' Association are: Joseph H. Ralston, Albany, president; W. O. Fouch, Portland, vice-president; J. E. Kilkenny, St. Johns, secretary; John R. Tomilson, Portland, treasurer.

National Association of Electrical Inspectors.

THOMAS HENRY DAY, president, 59 Deerfield Street, Hartford, Conn.
JAMES BENNETT, vice-president, 524 Coristine Building, Montreal, P. Q.
WILLIAM LINCOLN SMITH, secretary and treasurer, Concord, Mass.
JAMES E. COLE, National Conference Representative, 11 Wareham Street, Boston, Mass.

Executive Committee:

H. S. WYNKOOP, chairman, 13 Park Row, New York, N. Y.

Frank R. Daniel, R. P. Strong, Henry E. Knight, Washington Devereux, James B. McCarthy, W. Lincoln Smith, James Bennett, C. W. Mitchell, George L. Collison, T. H. Fritts, James S. Meade, T. Henry Day, James E. Cole, Thomas D. McColl

Secretary's Message.

Nelson F. Tetro, who has been superintendent of fire alarms and inspector of wires at Northampton, Mass., has resigned that position and taken up the business of general electrical contracting.

H. S. Wynkoop has gone on an extended trip to Central America, and consequently has been unable to contribute replies to the questions sent out in the last bulletin. However, as he has never failed in the last year and a half to send in complete replies in each case, the secretary does not begrudge him this respite.

The secretary calls the attention of members to the hint conveyed in two of the answers to Question 207, that the question does not deal with interpretation so much as with simple knowledge of the Code requirements. Again the secretary has been asked if some of the questions are actually field questions or merely hypothetical. Over 95 per cent of the questions which have passed through this office up to date are actual questions which have arisen in the ordinary day's work, between the parties.

The suggestion made in the eighth answer to Question 206 appeared of sufficient interest for the secretary to write to two of the leading fuse manufacturers on the subject and he received the following replies:

"In answer to your inquiry, we would state that there is no objection whatever, either theoretically or practically, to using a 600-volt fuse on a 110-volt circuit, the ampere capacity being correct.

"The action of the fuse is dependent entirely on the watts generated in it, which is a function of the current passing through the fuse and the resistance of the fuse. The resistance of a fuse of any given voltage and ampere capacity is practically constant under all conditions, and when the proper current is flowing, the watts generated must be entirely independent of the voltage across the load (not the voltage across the terminals of the fuse itself).

"We wish to call attention to one difficulty experienced in using ordinary fuses on very low voltages. When a 250 or 600-volt fuse is used on a circuit of less than 30 volts, the fuse will still be blown properly, but the indicator which makes a black spot in the centre of the label to show that the fuse has blown, will become uncertain in its operation. At any pressure above 30 volts, however, this effect is not encountered."

"We have your letter of November 16 and carefully note your remarks. In reply wish to say that we can see no objection to using a 600-volt fuse on a 110-volt circuit. It would take a slightly longer time to blow this fuse on a 110-volt circuit than it would if a 250-volt fuse were used, although both of them will blow within the prescribed limits as laid down in the Code. The only objection that we can possibly see to the use of this fuse would be in the additional expense involved."

Following out the idea the secretary has made oscillograph tests of a number of fuses of identical ampere capacity but of the two different ratings, under several different conditions, from slow letting go to short-circuit break, and has found that unquestionably there is a time retardation, but in each case the effect was too small to be of any great importance.

The secretary has received notice of the biennial meeting next March of the Electrical Committee of the National Fire Protection Association, which has charge of the revision of the Code. If any of the members have any suggestions for modification of the Code and will send them to him *before December 25*, he will see that they are properly forwarded to the secretary of the Committee, in time for use.

The matter appearing in this section consists of questions on the National Electrical Code, its interpretation and meaning, and questions as to whether certain methods of wiring are in accord therewith. These questions are gladly received from anyone interested, even if not a member; they should be sent to the secretary with any needed elucidating sketch. They are answered by each member of the Executive Committee according to his knowledge of what the ruling would be in his jurisdiction.

It should be understood that no pretense is made to give an authoritative interpretation of the Code. This is a voluntary association; it has representation on the Electrical Committee of the National Fire Protection Association, which prepares the Code, but it has no right, and claims no right, to give a final interpretation of anything in the Code. It is only intended to give the interpretation which seems correct to the members of the Executive Committee. No attempt is made to edit or correlate the answers from the different members of the Committee, as it is felt that the occasional difference of opinion is calculated to lead to a further study of the matter in question, further discussion and the final clearing up of obscure points.

The aim is to help toward a better understanding of the Code on the part of all; a more uniform conception of its meaning; increased precision in applying it; and harmonious action of those using it, for the common good.

Use of 600-Volt Fuses on 110-Volt Circuits.

Question 206. Is there any objection under the Code or otherwise to the use of inclosed cartridge 600-volt fuses on an ordinary 110-volt circuit?

Answer 1 (F). No, not if the ampere rating is sufficient to properly protect the circuit.

Answer 2 (H). I should say not; provided, of course, the capacity of the fuse, in amperes, does not exceed the safe carrying capacity of the wires.

Answer 3 (J). I see no objection under the Code or otherwise to the use of 600-volt cartridge fuses on an ordinary 110-volt circuit, provided they are mounted in the proper 600-volt cutout, as would be required by Rules 67*o* and 68*e*.

Answer 4 (B). I know of nothing in the Code which prohibits the use of 600-volt fuses, cartridge inclosed type, on a so-called 110-volt circuit. It surely will give the protection desired. There is a question, however, as to the advisability of encouraging such construction. When such fuses operate, the party possibly sends to the supply store for new fuses; on his stating that the circuits are of 110 volts (so-

called) potential, he is given fuses which will not fit the 600-volt cutouts, and the much dreaded piece of copper wire or other substitute is very liable to be inserted in the cutout in lieu of proper fuses.

Answer 5 (K). No; we can see no objection to the use of 600-volt cartridge fuses on a 110-volt circuit of the usual type. The practice would be permitted in this territory.

Answer 6 (O). The voltage rating on fuses means the maximum voltage, and there is no objection to using any standard fuse on a circuit below its rated voltage.

Answer 7 (E). I am unfamiliar with any restriction, in the Code, that would prohibit the use of 600-volt fuses on an ordinary 110-volt circuit. From an economic point of view, however, for the person who was paying for the fuse, it would not be the proper thing to do. There is, though, a restriction in the Code against the use of 110-volt fuses on a 600-volt circuit.

Answer 8 (N). There is no objection under the Code, but the question furnishes some food for thought, such as, Is it possible that the increased energy-absorbing and dissipating capacity of the higher voltage fuse may increase its time element when used on the lower voltage, so that it might take a longer time to let go than the properly rated fuse?

Burying Flexible Conduits in Brick Walls for Switch Loops.

Question 207. In a concealed knob-and-tube installation, is it permissible to install flexible conduit for switch loops, burying the same in brick walls, conduit merely running from switch box to tap joint in the ceiling above? If so, is it necessary to place a junction box at the connection point in the ceiling?

Answer 1 (O). The Code places no restriction on flexible conduit as distinguished from rigid conduit. There should certainly be a junction box at the upper end of the conduit (Rule 28*b*), and this junction box must be flush with the wall or ceiling in order to make it accessible (Rule 28*g*). The most workmanlike installation would be to run the conduit continuous from the switch box in the side wall to the fixture in the ceiling, as the junction box in the ceiling would then be covered by the fixture canopy.

Answer 2 (E). Under the conditions expressed in this question this form of construction is, in my judgment, permissible under the Code; provided, of course, the wire is not drawn into the conduit until the mechanical work of the building has been completed and an outlet box at the end of the conduit has been installed, either at the outlet or at an outlet provided immediately above the switch, as indicated in the second paragraph of the question.

Answer 3 (F). Yes; flexible conduit may be buried in a brick wall if the wall is not permanently damp. Conduit should terminate in an approved outlet or junction box, which should be accessible and flush with the finished surface. (See Rule 28, Sections *b* and *d*, National Electrical Code.)

Answer 4 (H). If by the words, "flexible conduit" it is intended to mean circular loom, the construction indicated in this question would not be allowed.

Any lines buried in brick walls should be conduit, "Greenfield," or its equivalent, run into an iron switch-box in the wall. At the connection point in the ceiling, if the conduit were bushed and securely fastened in such a way as to prevent strain upon the wires of the sub-circuit, the junction box might be omitted.

Answer 5 (N). Yes, it is permissible, provided the switch is placed in a box which is properly entered by the conduit. It is not necessary to place a junction box at the connection point overhead, as a condulet or similar fitting, properly attached to the conduit, is sufficient. If the brick wall were subject to permanent moisture I should require either rigid conduit or lead-sheathed armored cable, as suggested in Rule 27*d*.

It seems to me that this question is not related so much to Code interpretation as to the plain Code requirements.

Answer 6 (K). In this jurisdiction the installation of the switch loops in flexible steel conduit is approved, and the conduit may be buried in brick walls in the manner contemplated in the question. A junction box of an approved type is always insisted upon where the switch loop is connected to the knob-and-tube circuit.

Answer 7 (J). The Code makes little or no distinction between rigid and flexible metallic conduits, only stipulating that the flexible must "afford protection substantially equivalent in all respects to that afforded by rigid unlined metal conduits."

I should consider this construction equally satisfactory with the similar use of armored cables, expressly permitted under Rule 27*d*, second paragraph. It would most certainly be required that the conduit or cable terminate in an accessible outlet box of approved type (see Rule 28*d*), but consideration for appearance would suggest that this box should be placed, in general, at the nearest ceiling outlet.

Answer 8 (B). It is not permissible to install flexible conduit for switch loops burying the same in brick walls, conduit merely running from switch box to tap joint in ceiling above. Rule 26*i* definitely states: "When using either conduit or armored cable in mixed concealed knob-and-tube work, the requirements for conduit work or armored cable work must be complied with, as the case may be."

By referring to Rule 27*a* and Rule 28*b*, it may be seen that armored cables or interior conduits must be continuous from outlet to outlet or to junction boxes, etc.

It would appear as if this question was asked, not from inability to interpret the Code, but from unfamiliarity with the Code rules themselves.

Examination for Laboratory Assistant.

The United States Civil Service Commission has announced an open competitive examination to be held on January 8, 1913, for laboratory assistant in physics in the Bureau of Standards, Washington, D. C., at salaries ranging from $900 to $1,200 per annum. Certain of the eligibles will be selected to work in electricity and the option is given of choosing this as one subject of the examination in place of advanced general physics. An educational training equivalent to that required for graduation from a college or technical school is a prerequisite, and this and previous experience of the applicant count for one-half of the total credits given in the examination. The examination will be held at the usual places.

Colorado Men on Denver Committee.

Three members of the Colorado Electric Club were appointed on the Denver Chamber of Commerce committee considering the advisability of bonding the city of Denver in order to construct a tunnel through the main range of the Rocky Mountains under James Peak. The purpose of the tunnel is to furnish a shorter route to the Pacific Coast for the recently re-organized Denver, Northwestern and Pacific Railway.

The Electric Club members appointed are W. G. Mathews, president of the club; H. L. Wolfenden, local General Electric Company representative, and C. F. Oehlmann, secretary and treasurer.

Legal Notes

LIABILITY OF CENTRAL STATIONS FOR FAILURE OF SUPPLY.

By Maguire and Mooney.

A company is liable for damages if it refuses to furnish current without sufficient reason, unless the contract particularly relieves it from continuous service. Interruptions from act of God do not render it liable, and it may refuse service where premises are improperly wired, or where a customer is stealing current.

There are times when central-station service is interrupted by breakdowns either in the power house, to the transmission lines, or by fire. Of course, such interruption is always carefully guarded against by the public-service companies because of the loss occasioned by failure to supply the current, and for that reason there are not many cases arising from these causes. But on such failure can the central-station company be held liable for any damages arising from any such interruption to its service? Nowadays the ordinary contract submitted by the central-station company to its customers covers such features and protects the company clearly. But stripped of this it is well to know the full relationship of the company to its customers when no contract varies the relationship. For instance, in most of the contracts nowadays the company does not guarantee a regular and uninterrupted supply, and does not bind itself for any damage in case the current should fail, be defective or interrupted by the company's negligence, or any other cause.

If the central-station had to temporarily shut down on account of lack of coal caused by a strike, what would the customers do? Assuredly they would be damaged, but what liability would rest upon the company under such circumstances?

If the company makes no reservations in its contract it is not relieved. If there are no restrictions, then it is important to consider what rights the customers have to proper service, and to regular supply. As a matter of sequence it is necessary to consider questions where companies refuse without any physical reason.

In the case of Reister vs. Edison Electric Illuminating Company of Brooklyn, 137 N. Y. Supp., 145, Benny Reiser claimed certain penalties by reason of the company's failure or refusal to furnish electricity for lights. The law of New York required an electric light corporation to furnish current to the owner or occupant of any building upon written application and payment of all money due to the company, and if, on the expiration of ten days such corporation shall refuse or neglect to supply current, a forfeit of a stated amount each day shall be due to the applicant. The court did not grant Reiser's petition in this case, as he could not prove the written application. For the same reason an electric company may adopt reasonable rules and regulations and prevent or at least attempt to prevent customers from doing injury. In the case of Benson vs. American Illuminating Company, 102 N. Y. Supp., 206, Benson, a dentist by profession, was a customer of the company. The company put in a meter and performed all necessary wiring and made connections with a bull's-eye reflecting light which Benson then had and used in front of his dentist chair, for use on dark days and at night for illuminating the patient's mouth. Subsequently the plaintiff did some wiring himself, beyond this light to a sign out of a window, and also to a lathe, and which was a live wire beyond this light when the switch was closed. The company informed Benson that this wiring was defective and dangerous; that the connection near the chair might cause injury to some one, and that the building might be set on fire. Still when the wires were not removed nor permitted to be removed the company shut off the current. Benson sued for damages. The court held that inasmuch as it was the duty of the electric company to make its wires safe where they were liable to come in contact with persons, it acted properly under the circumstances. The company was clearly within its rights when it refused to longer allow its electricity to run through these defective wires and thus avoid any possible liability of fire or accident to any person on its part. Whatever damage was suffered by Benson was largely through his own fault.

And before going directly to the main question it is important to determine just what right the company has in refusing current to one who has been diverting it. In Garner vs. Springfield Gas and Electric Company, 135 S. W., 1023, Gardner was operating a moving-picture show in Springfield, Mo. The Springfield Gas and Electric Company was organized under the laws of Missouri and operated an electric light and power plant in that city. A contract was entered into between Gardner and the company by the terms of which the company agreed to furnish light and electric current necessary to operate the moving-picture show. It later became suspicious that Gardner was using more current than he was paying for. An investigation disclosed the fact that Gardner was using a shunt wire by which the current was being diverted around the meter, so that the meter did not correctly register all the current used by the moving-picture show. The company then sued Gardner for the sum it figured was due, and also turned off the current. Gardner in turn sued the company for loss of profits during the time the show was closed. The company contended that Gardner entered into the contract with the intention of defrauding it and that he fulfilled such intention. The court held that in an action for loss of profits resulting from this turning off of the electric current, in violation of the contract, Gardner could show the receipts and expenditures for a reasonable time before the current was turned off, but that the turning point of the case would rest upon the fact whether or not the current had been diverted.

Electric light companies which, by their charters or franchises with municipalities, enjoy practical monopolies, may be compelled to furnish the current in reasonable quantity, on the same terms on which it is supplied to others, to one inhabitant who is willing to comply with such terms. They cannot fix a variety of prices nor impose different terms and conditions, according to their caprice or whim, but they will have a reasonable time allotted them in which to make necessary repairs. All rates shall be uniform, but that

does not mean that the company cannot give its customers the benefit of a discount if they pay their bills promptly, and the company may charge extra for an excessive use of the current; that is, the company, in addition to its regular meter charge, could add a rate that would be fair, but that extra rate would have to be added to all that used the same amount of current. This was decided in Southwestern Telegraph & Telephone Company vs. Murphy, 140 S. W., 720, where Murphy was a customer of the company, and he had service at his residence in Hot Springs. In March, 1908, the telephone got out of repair and was in such bad shape it could not be used by Murphy at all. He notified the proper department of the company several times and was promised each time that the repairs would be made. They were not made until the latter part of March and when a collector called for the payment for April service, which was payable April 1 in advance, Murphy refused to pay unless he received credit for the three weeks in which he received no service. The telephone was thereafter taken out. Murphy then sued for the statutory penalty of $100 a day for failure to furnish him service. The court held he could not recover $100 a day, because the company was not discriminating against Murphy. The purpose of the law was to force the company to treat all patrons alike and be impartial to all. These are the ordinary restrictions placed upon public-service corporations and mere neglect or inattention to repair Murphy's telephone would not make the company liable. He would have been entitled to a refund of some amount on account of receiving no service, but he could not get it in this case as he was not suing to recover that, but was seeking the penalty.

Likewise in Hesse vs. Imperial Electric Light, Heat & Power Company, 140 S. W., 911, the company was engaged in furnishing electricity for light and power to Hesse, who was engaged in the printing business, and who used the current to propel his motors. There was a contract between them for furnishing service, but the company refused to furnish it. The court held that Hesse could recover for all damages that necessarily resulted from the breach of the contract. If Hesse had any printing contracts on hand that he lost because of the lack of electric power, the profits that he accordingly lost could be charged up against the company and it would have to pay.

Public-service companies cannot be held to be insurers of adequate service. There are so many elements that enter into the make-up of good service, a number of which are beyond the ordinary control of the company, that it should not be held strictly to account. Because of the fact that electric companies have faithfully performed their duties in the past, no case has come to the attention of the higher courts that has involved the question of adequate service in its definite aspect. For this reason no important citations can be made. Nevertheless electric companies are facing these problems each day, and it is to be expected that some day one company at least will err and necessarily have to close down its plant for a time. Coal strike, lack of water power, flood, storm—all in turn may cause a shortage of current, and consequent damage to the company's customers.

A company cannot contract against its own negligence. Its contracts in this respect will always be construed against it.

A late case in New York has been used as an argument against securing light, heat and power from central-station companies because the court held a contract between the company and one of its customers to be unenforceable. Upon this decision those advocating individual plants or steam equipment are making merry. The case decides nothing that should act as a warning to central-station customers. The Globe Woolen Company made a contract with the Utica Gas and Electric Company for five years with the privilege of renewal for five years more, the electric company agreeing to furnish current at 1.04 cents per kilowatt-hour. Later on, after some years trial, the electric company found it had delivered to the woolen company current of the value of about $70,000 for which it had received no compensation. The electric company found readily that it had entered into a grossly inadequate contract, and also discovered that the contract had been negotiated and consummated by the president of the woolen company, who also acted as chairman of the executive committee of the electric company. Because of the president's connection with both companies, and the state of facts, the court held that the contract was inequitable and unconscionable because the president of the woolen company had sought to obtain financial benefit at the expense of the electric company.—Globe Woolen Company vs. Utica Gas and Electric Company, 139 N. Y. Supp., 24.

The electric company, in the absence of contract, is entitled to the defense of act of God, but it is necessary first to determine what an act of God really is. It may be defined as that which cannot be reasonably expected to occur, or that which human agency cannot guard against. A flood may or may not be an act of God. If floods had occurred frequently in a locality they would necessarily be expected and would not be an act of God in this sense. A strike would not be an act of God, a storm might be an act of God or it might not. The case of Wilson vs. Boise City, 117 Pac., 115, holds that a rainfall or cloudburst which has irregularly and infrequently occurred a number of times within the memory of man in a certain locality and has caused heavy freshets in a particular stream, is a thing that can reasonably be expected to occur again and thus is not an act of God.

Interesting Cases.

TAXATION OF FRANCHISE.—The Supreme Court of California reversed the decision of the lower court in the case of the Postal-Telegraph Company, which brought suit to recover $625 in taxes, paid under protest. The sum was assessed upon its right to operate in Los Angeles. The company won its suit in the lower court on the ground that it was operating a federal franchise granted under an act of Congress and that a tax for a franchise to operate within the state was unconstitutional. The Supreme Court ruled that a federal franchise does not necessarily give unincumbered right to occupy state highways.

TELEPHONE MERGER UPHELD.—The Supreme Court has decided against the city and county of San Francisco in the suit brought to set aside the sale of the Home Telephone Company to the Pacific Telephone and Telegraph Company. The city sued to set the sale aside on the ground that it was voided by a provision in the Home Company's franchise forbidding it to sell or transfer its property, right or privileges under the franchise. Judge John F. Ellison holds that this provision is null and upholds the defendant corporations' demurrer to the city's complaint.

"I find nothing in the provisions of the charter of the city and county of San Francisco that either expressly or by inference confers upon the city the power to place in the franchise the provision that the grantee thereof should not sell or dispose of its property. No law of the State conferred such power and the condition is clearly [illegible] policy of the State."

"If A should make a valid contract on good consideration with B that he would not sell his mercantile business to anyone but B or with his consent, and A should notwithstanding said contract, sell his mercantile business to C, I apprehend no court would hold that B could follow the property into the possession of C and ask the court that it retransfer the same to B. He might have some kind of an action against A, who had broken his contract."

Public Service Commissions

NEW JERSEY.

The Board of Public Utility Commissioners has denied an application of the Trenton Chamber of Commerce for suspension of a proposed increase of fifty cents per month in the charge for residence service by the Delaware and Atlantic Telegraph and Telephone Company. In ruling on this matter the Board states that the ordinary application made to the Board for the suspension of increased rates comes to the Board without any specific knowledge on its part of the particular circumstances under which the increase is made. The Board has been for some time investigating the rates charged by the Delaware and Atlantic Telegraph and Telephone Company in the City of Camden. The proposed increase in Trenton will result in equalizing Trenton rates with those of Atlantic City and Camden. The Board states that the evidence in the Camden case is sufficient to rebut the presumption which ordinarily would exist in favor of the established rate in Trenton. The increase is declared to be *prima facie* in the nature if eliminating discriminatory and preferential rates for the Trenton area. At a recent hearing before the Board it was agreed by the Trenton Chamber of Commerce that it would not push its complaint as to the reasonableness of the Trenton rates until after the decision of the Board on the reasonableness of the rate charged in Camden.

The Board has denied that the New Jersey Gas Company has a right to establish a minimum rate charge. Complaints were made that the company was, by the ordinance granting a franchise to the company it succeeded, restricted to a charge not to exceed $1.50 per thousand cubic feet. The Company established a monthly charge of fifty cents to be paid whether enough gas was consumed at the regular rate to make this amount or not. The Company contended that this did not violate the ordinance, in that the minimum monthly charge of fifty cents was not for gas furnished, but the charge for being in readiness to supply gas. This construction of the ordinance was not accepted by the Board. In its finding in this matter, the Board expressed the opinion that a reasonable minimum charge is proper, provided the Company has not contracted itself out of the right to include such a minimum charge in the price it sets for gas; that in this case the Company had contracted itself out of such right.

NEW YORK.

The Public Service Commission, Second District, has directed its counsel to commence an action against the New York Telephone Company for failure to comply with the Commission's order made on October 15, directing it to furnish telephone service to the Metropolitan Telegraph and Telephone Company.

The Commission has authorized the Syracuse Lighting Company to issue $197,000 of its extension and improvements six-per-cent ten-year gold bonds; the bonds are to be sold at not less than 99 and the proceeds used for various extensions and improvements of its gas and electric service in the city of Syracuse.

The Commission has authorized the Wyantskill Hydro-Electric Company to execute a mortgage to secure an issue of six-per-cent five-year bonds to the aggregate amount of $50,000. The company is authorized to issue presently $4,500 of its common capital stock and $7,500 of its bonds, the proceeds to be used for the payments of amounts due for additions and extensions of its plant and proposed new construction. The company operates in West Sand Lake, Averill Park and surrounding country.

The Commission has given its approval to the sale of the power plant of the Rochester, Syracuse & Eastern Railroad Company at Lyons and the power plant of the Auburn & Syracuse Electric Railroad Company at Auburn to the Niagara, Lockport & Ontario Power Company. The approvals are given upon the express condition that they are not in any event to be construed as an authorization for the Niagara Company to distribute power or electrical energy or to operate in any territory whatsoever as an electrical corporation by reason of any agreement which would otherwise require the authorization or consent of the Commission. The approval is also not to be construed as an approval of any construction of transmission lines by the Niagara Company, and any further construction requiring the consent of the Commission must be taken up in a separate proceeding. Under the terms of a contract approved by the Commission the power company is to sell electric power to the so-called Beebe roads for a term of 20 years from December 1, 1912. A provision is made for the furnishing of all power needed for the operation of the road or other extensions, additions and improvements connecting roads, etc. The railroads agree to purchase exclusively from the power company during this term. Under the new arrangement the electric railroads will have not only the service of the Niagara, Lockport and Ontario Power Company but the benefit of the steam reserve plant located near the eastern end of its transmission lines, which will give to the railroad company's supply of power east of Rochester better regulation and greater safeguards against interruptions of service.

The Commission has also authorized the Niagara, Lockport & Ontario Power Company to incur an indebtedness of $600,000 for the purchase of the Lyons plant and a further indebtedness of $226,000 for the purchase of the Auburn plant.

The Commission has adopted a set of regulations, effective on January 1, 1913, prescribing the form and governing the filing and publication of rate schedules of telephone corporations subject to its supervision. The order requires that the tariffs of all such telephone corporations must be printed, and prescribes the form.

The consolidation of the Bell and Independent Telephone Companies in the counties of Clinton, Essex, Franklin and St. Lawrence in northern New York, with minor extensions into Warren and Washington Counties, will follow the order of the Commission, authorizing the Mountain Home Telephone Company, which is to be the name of the single remaining corporation, to increase its authorized capital stock from $150,000 to $1,000,000 and to execute a mortgage to cover all its present property, to secure an issue of five-per-cent bonds to the aggregate maximum amount of $2,000,000. The company is authorized to issue capital stock to the amount of $633,000 and bonds to the amount of $1,004,200. On August 6 the Commission denied the application now granted, stating at that time that the general purpose of

the consolidation met with the approval of the Commission and the amount of stock and bonds to be issued was reasonable for the purposes required, but that it developed at public hearings that it was the purpose of the Mountain Home Company after acquiring the properties in question to put in a new schedule of rates which would effect a very considerable increase to a large number of subscribers. The company did not at that time convince the Commission that the proposed raises were justifiable and the application was denied. Since that time negotiations have been had with the company and as a result a new schedule of rates has been submitted designed to meet the objections raised by the Commission. Under the new schedule of rates 196 subscribers to the Bell Company will be increased an aggregate amount of $1,098 and 1,124 subscribers of the independent companies will be increased an aggregate of $7,189, making a total of 1,410 subscribers whose rates will be increased an aggregate of $8,287. The rate of 200 subscribers to the New York Telephone Company will be decreased $612. The consolidation of the company will eliminate 689 duplications with an aggregate saving to the subscribers of $13,400 by reason of such eliminations. A total decrease for the entire territory, occasioned by decreases in rates and elimination of duplication will, therefore, for 889 subscribers accomplish a total saving of $14,012. The net annual saving to the subscribers in the territory will with offsets amount to $5,725.

MASSACHUSETTS.

The Massachusetts Railroad Commission has granted authority to the Bay State Street Railway Company to carry freight, express and baggage in the town of Rockland.

OHIO.

The Public Service Commission has authorized the Dayton Power & Light Company to issue six-per-cent cumulative preferred stock of the par value of $150,000. The company is authorized to purchase the capital stock of the Miami Light, Heat & Power Company of the same par value and issue its own stock in payment therefore to the present holders of the Miami Company's stock.

VIRGINIA.

The State Corporation Commission has authorized a merger consolidating the Washington - Virginia Railway Company with the Washington Utilities Company, the capital stock of the merged corporations to amount to $50,000,000.

WISCONSIN.

The petition of the Commercial Club of Superior applying for a reduction in the price of gas was considered by the Wisconsin Commission in a decision recently issued, but no change in the present rates was ordered. The investigation disclosed the fact that the surplus for the year ending June 30, 1912, aggregate 6.75 per cent upon the present value of the property plus an allowance for depreciation. It was held that the utility was entitled to earn interest upon a valuation which included a liberal allowance for going value as well as for bond discounts. During the progress of the case, the company put into effect a schedule of reduced rates consisting of a primary charge of $1.00 net per 1,000 cubic feet for the first 20,000 cubic feet used per month, and an excess charge of 80 cents net. At the hearings the petitioner laid particular stress upon the fact that the rates in Duluth were considerably lower than the rates in Superior, although gas is purchased by both utilities at approximately the same terms. A considerable portion of the decision was devoted to a comparison of the two utilities. It was pointed out in this comparison that, in as much as the Duluth plant is a municipal plant, no allowance has been made in the rates, for taxes and depreciation and very little for interest. The Commission was of the opinion that rates based upon operating expenses including these items would be as high, if not higher, than the rates in Superior.

In the case of the Milwaukee Electric Railway & Light Company against the Wisconsin Commission, Judge Stevens, of the Circuit Court, has ordered a stay of execution of the judgment rendered against the plaintiff, during the pending of an appeal to the Supreme Court. The stay of execution also includes the order of the Commission requiring the sale of thirteen street-car tickets for 50 cents. The company was ordered, however, to continue to issue a coupon with every sale of tickets, which coupon is to be good for one fare in case the company loses its case. Judge Stevens has also granted a temporary injunction restraining the Commission from enforcing its recent order requiring the Duluth Street Railway Company to issue six tickets for 25 cents on its Superior lines. It is claimed that the Commission's order would effect a reduction of about $32,000 a year, and that the Commission is without jurisdiction to make an order regulating fares.

The Commission has issued a decision in which the Southern Wisconsin Railway Company is ordered to so re-route its cars as to affect a five-minute headway on the main portion of its system.

In response to an application of the Boscobel Telephone Company, the Commission has ordered a physical connection between the petitioner's system and the lines of the 20 companies named as respondents in the case. Until recently the Boscobel Company has been furnishing switching service to the respondents, from which it has received little remuneration. The case was brought to the Commission upon the failure of the companies to agree upon terms and conditions. A charge of $1.50 per year was ordered by the Commission, which charge is to apply to each rural telephone which can ring the Boscobel central directly. The Union Telephone Company of Pairie du Chien has been authorized to establish a switching charge of $2.50 per telephone per year.

High-Candlepower Tungsten Street Lamps in London.

In the reorganization of the street lighting of the Borough of Holborn in London, England, extensive use is being made of tungsten street lamps. Nearly all of these are grouped in special lanterns. These are of three types to correspond with the importance of the thoroughfare. On the main street are 20 standards, each carrying a lantern over four feet in height and mounted 21.5 feet above the street surface. Each lantern contains three 600-watt tungsten lamps and above the lamps is a specially shaped white reflector. The lanterns are practically airtight, so that the fortnightly cleaning that they receive is confined to wiping the outer glass surface of the lantern only; the lamps and the reflector remain free from dust for many months. To get at the interior of the lantern, which is seldom necessary, the entire top must be removed; it is fastened by a spring catch and can be easily lifted off by a man on a tower ladder such as is used for the cleaning. The entire unit gives an average of over 1,800-candlepower between the angles 20 and 50 degrees below the horizontal, this making probably the most powerful tungsten-lamp unit in existence. The standards are placed about 90 feet apart.

On the less important streets are standards quite similar to those described, but smaller. The lanterns are 18 inches high and contain three 115-watt lamps. These units give an average of 400 candlepower between the angles referred to. On still less frequented streets are posts remodeled from gas service by being equipped with a new 15-inch lantern containing two lamps that give 90 candlepower. These are placed about 75 feet apart.

LETTER TO THE EDITOR.

Early Telephone Experiment.

To the Editor:

In discussing things electrical with a friend, I told him of an incident that happened many years ago, when a youngster, and through the instrumentality of a private telegraph line, built by myself and two friends. He asked me to tell the story to your publication, feeling that it would be of sufficient interest to repeat in such a way to your readers.

In 1873—at the latest 1874—if I correctly remember, my old-time friends, B. R. W. (since dead), and David McK., now living in Los Gatos, Cal., put up a telegraph line from the southwest corner of Sacramento and Leavenworth Streets, San Francisco, Cal., to Taylor and Ellis Streets, the location of my old home. In due time we became proficient in telegraphy and derived no end of pleasure from this old line, in confabbing amongst ourselves, and in interesting other youngsters in the same line of work. The initial installation was a line over the house tops, and varied experiences were gone through with in getting this line up. The placating and talking necessary to obtain permission from the numerous householders to use their dwellings as poles, was extreme, but we finally completed our task. There were at that time no wires to be crossed that I remember outside of the fire-alarm system, and as that was not a complicated one, I believe we ran across same but two or three times.

Now the incident I wish to speak of was as follows. The offices (3) were equipped with 80-ohm sounders, and simple blue-stone batteries—which was all contained in and upon a walnut desk with sloping top and hinged to hold writing material within. On the back of desk on the level beyond the hinges stood the sounder, with key on lid with flexible-cord connection. The sounder was placed upon a cigar box, with the top of box cut out with the counterpart of the scrolls on the belly of a violin, constituting a sounding board—amplifying the stroke of sounder.

One night David McK. and myself went to see the old time Billy Emerson Minstrels, came home full of the enjoyment of the evening and went to our respective rooms two blocks apart, ostensibly to bed, but really to use the line and swap a few words before turning in. In order to get around the objections of my good father, who disliked my sitting up all night and talking when I should have been in bed, the cigar-box sounding box played its part. It was my custom to screw down the armature of that old sounder (I have it even now) so close to the magnet that its motion could not be seen, and *not heard* unless one placed his ear to the top of the table, with head on one side and closely held to the woodwork. Then the tick could be caught, and the household thought I was sound asleep.

This night, while so placed, I distinctly heard David McK. say: "Oh, Gus! Come here," his brother's name being as above. I opened the key, after a moment's hesitation and asked him (by Morse) if he had called his brother? He answered, "Yes, how did you know?" I said, "Talk to him some more, I can hear every word you say."

There it was, the telephone, pure and simple, and the reason, now that we know the whys and wherefores, fully as plain. The armature, with its vibrations imparted to, and amplified by the cigar box; said vibrations traveled down through the desk cover and directly into my closely held left ear, glued down to the desk top, excluding all outside sounds. Reporting the experience the next morning, I was smiled at and had some difficulty in making him believe my statement. We tried repeatedly to get this to happen again, but unsuccessfully, as it was the synchronism of the two instruments exactly in unison, and all conditions correct.

The advent of the phone later on, first through the pages of the *Scientific American*, if I remember rightly, in an illustration, made me get an old lathe I had, busy for the boxes, and Paul Seiler (now in San Francisco) two or three bar magnets, and in short order that old line *had telephones*. People came to the house almost every evening and my friend, B. R. W. on Sacramento Street, used to drop his phone in the piano and play for the edification of my visitors. My uncle, later Professor Davidson of the United States Geodetic Survey, asked me to come and see his phones. They ran from basement to upper story, of the old United States Survey Building on Stockton and Post Streets, San Francisco, and these were of box form and as large as a candle box and not nearly as good in working ability as the ones I had made. I well remember my father telling the members of the Pacific Union Club, of which he was a member, and composed of the best of San Francisco's business and professional men, and their non-acceptance of his story, and their coming up to Bill Moors to see and hear—Hall and Custer McAllister, two of the best jurists on this coast, Judge Ogden Hoffman, Major R. P. Hammond, John Benson and many others well known. To them it was a curiosity.

Howard Coit, the speaker of the Stock Exchange and an old Western Union man, lived on Taylor Street and his back yard abutted ours. One afternoon, while talking to B. R. W., Mr. Coit motioned to me to raise the window. I did and he asked me if I had a telephone. I answered, "Yes." He said: "Can't you bring it over here?" I got a coil of fine wire I had, detached the gas-fixture ground, hitched on and threw the coil to the yard, thence over the fence to his yard, through kitchen to dining room—and then gas fixture again. B. R. W. was on deck and talked to Mrs. Coit (one of our oldest Californians and still with us) and to Mr. Coit, to their great satisfaction.

The kitchen door opened and the Chinese cook, Ah Fong, stuck his head through—and then followed slowly with his body, not understanding the peculiar proposition of Mr. Coit talking into a small round long piece of wood and a wire on the end of it. He finally said: "What you do?" Mr. Coit said: "You come talkee, talkee Mr. Moor's friend, Mr. W.—He live Sacramento and Leavenworth Streets." Fong said: "Oh, you too muchee foole; no can do." Well, after some little teasing and getting him to place the phone to his ear, and accustoming him to the breaking of contact, I telegraphed B. R. W. with the wire ends to call to him when I gave the signal and swear in Chinese. This he did. Fong opened his hand, let the phone drop and said, "Jee Cli" and ran into the kitchen as pale as a banana peeling and frightened in a most convincing way. He evidently thought the devil was in that box without a doubt.

With so much accepted, improvements of all kinds at hand, one seldom goes back to primal times and loses sight of the days when such servants were not at hand, such as the necessary telephone, but I often wonder, if I had been older, and had I fully realized the import of those few words heard through that old sounder, what would have followed.

EDWARD N. MOOR.

Oakland, Cal., Nov. 12, 1912.

Washington Conference on Water Powers.

A number of hearings have been held in Washington, D. C., before the Secretary of the Interior at which were present representatives of the State of California, the City of San Francisco, attorneys and engineers representing water-power companies, and others interested in water power and water-power regulation. These hearings began on November 18, and continued, from time to time, until November 30.

The subject of these hearings were the regulations approved August 24, 1912, "Concerning Permits for Rights of Way for Power Purposes Through Public Lands and Reservations Except National

Forests," and the application of the city of San Francisco for the proposed use of the Hetch Hetchy, Eleanor and Cherry Valleys, of California, within or near to the boundaries of the Stanislaus United States National forest reserve and the Yosemite National Park, to construct a new water system for the San Francisco Bay region.

On the application for the proposed use of the Hetch Hetchy and other valleys by San Francisco for the proposed new water project it is expected that decision will not be immediately announced by the Secretary of the Interior.

Among the constructing, operating and financing firms and corporations represented by officers or attorneys from a distance were J. G. White & Company, of London and New York; Stone & Webster and E. H. Rollins & Sons, of Boston; the California - Nevada Power Company, Great Western Power Company, Southern California Edison Company, and Mount Whitney Power Company, of California; the Northwestern Electric Company of Oregon, the Washington Water Power Company of the State of Washington, the Great Falls Power Company and allied interests of Montana. The Northern California Power Company, the Twin Falls (Idaho) Land and Water Company, and the Central Colorado Power Company, and other Western operators were represented by local counsel. Officials of the State of California and of the Departments of Agriculture, War, Interior, and Commerce and Labor participated. Especially significant for the companies was the discussion by Oscar T. Crosby, of the city of Washington; Richard M. Saltonstall, of Boston; Josiah T. Newcomb, of New York; H. H. Trowbridge, of Los Angeles; Guy C. Earle, of San Francisco; D. L. Huntingdon, of Spokane; C. F. Kelley, of New York and Butte, and W. P. Lay, of Gadsden, Ariz. For the Federal Government, Secretary Fisher in person carried the burden of debate, but significant suggestions were made by Marshall O. Leighton, chief hydrographer of the Geological Survey; O. C. Merrill, chief engineer of the United States Forest Service, San Francisco; T. M. Robertson, of the Bureau of Corporations, and Philip P. Wells, chief law officer of the Reclamation Service. Professor Marx and Railroad Commissioner John M. Eshleman spoke for the State of California.

During the conference Mr. Crosby urged a policy of local rather than federal control. In this contention he was supported by Messrs. Trowbridge and Earle.

Secretary Fisher announced that his policy was based upon a purpose to insure a distribution of the benefits of the natural resources to the ultimate consumers, so far as possible in the form of lower prices and better service. Where steam competition is negligible and competition between water-power sites is practically abolished by a single control, effective regulation of the complete monopoly is possible, but the power to charge rentals should be reserved to the federal Government. Defective laws or lax administration on the part of the state may fail to protect the public from extortion. In that event the power to adjust the rental every ten years as contemplated by the new regulations will be a powerful stimulant to induce the reduction of prices, and failing that it will at least be able to transfer a considerable part of the undue profits to the public treasury.

Secretary Fisher stated that the Department approved the general principles of the pending Burton bill to regulate water-power development on sites owned by the federal Government. He considered them consistent with the regulations under discussion and with the views generally expressed at the conference. There was to be a committee hearing on this bill on December 4, and Mr. Newcomb said that he hoped it would be carried and passed at the coming session.

As an outcome of the conference it is likely that there will be a simplified procedure whereby the state and federal officers will act in harmony and with dispatch. It is probable that certificates from the California Water and Railway Commissions will relieve the Department of the burden of inquiry into the sufficiency of water supply for the project and the good faith and financial ability of the applicant.

While Secretary Fisher has not definitely ruled on the San Francisco application for the use of Hetch Hetchy Valley, it is understood that he has informed the officials that if he does decide to grant their application he thinks the city should take over the Spring Valley Water Company already in operation there, as it would be unwise public policy to authorize new water privileges on Government reservations where water facilities already exist. It would not be fair to the corporation to wipe it out of existence, as would be done if it grants San Francisco the privileges it asks without requiring that the city protect the existing water company.

Suggestion for Federal Testing Laboratory.

A circular letter has been sent out by M. Sarbinsky, city electrician of Cleveland, O., to other city electricians and persons otherwise interested in the subject, advocating the establishment by the federal Government of a laboratory with functions similar to those of the Underwriters' Laboratories, Incorporated.

BOOK REVIEWS.

"200 Municipal Ownership Failures." By Glen Marston. Chicago: Public Service Publishing Company. Paper, 32 pages. Supplied by Electrical Review Publishing Company for 25 Cents.

This booklet claims to be a compilation of the municipal water and lighting plants in the United States which have gone out of business, or which have admitted their inability to meet obligations out of operating revenue. Actually, several successful plants, and many which fail to issue reports, are included. The student of municipal ownership will find it of interest but not entirely reliable. The purpose is evidently to furnish facts regarding the most disastrous failures of municipal ownership and it is doubtful if any work on the subject contains so many instances in as limited space. There is no superfluous comment and the treatment is very concise.

"Wiring Calculations for Electric Light and Power Installations." By G. W. Lummis Patterson. London: Scott, Greenwood & Son. Imitation leather, 96 pages (5x7¼ inches), illustrated. Supplied by the Electrical Review Publishing Company for $2.00.

This little volume is a convenient compilation of facts, formulas and tables necessary for determining the size of wire for lamp and motor circuits. The explanations are given in simple language and are not mathematical, but a familiarity with ordinary algebraic formulas is necessary to apply the rules given. The size of wires is computed from the allowable voltage drop and from the carrying capacity of the copper. Although written primarily for English readers, the rules of the National Electrical Code are mentioned. The book contains 33 tables which constitute, perhaps, the most valuable portion of it. They include the electrical and mechanical properties of aluminum and copper, the tensile strength of aluminum wire, the carrying capacity of fuses, the wiring capacity of conduits and the current requirements of different sizes of alternating-current motors. Included in the last mentioned table are average values of the rotor currents of wound-rotor motors. The book will be found of value to contractors and wiremen wishing to determine the necessary size of conductors for a given duty, but the price seems somewhat high for the size of the volume and the amount of material contained therein. A complete copper-wire table would add to its value.

The United States has two-fifths of the total railroad mileage of the entire world and five times as many miles as any other country.

A MUNICIPAL LIGHTING PLANT IN A TOWN OF 400 POPULATION.

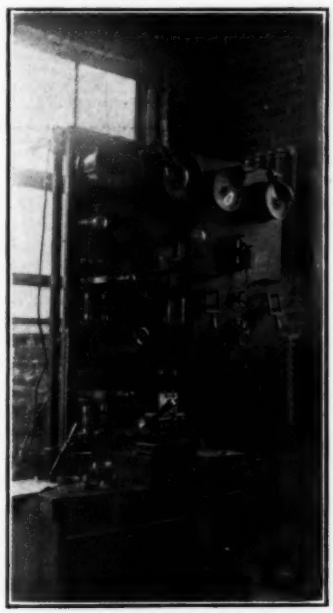
By George C. Shaad.

The city of Perry, Kans., is the smallest town in the State of Kansas, and one of the smallest in the country, to own and operate an electric power plant for furnishing both street and commercial lighting. This plant has been in operation, giving 24-hour service, since about the first of September, 1912. There are 29 tungsten street lamps and 37 commercial consumers. The commercial service is metered and customers are charged at the rate of 10 cents per kilowatt-hour, with a minimum monthly bill of $1.00. During the month of October the revenue derived from the commercial service was more than enough to pay all of the operating expenses of the plant, leaving the returns which should be received for the street lamps to apply toward the bond interest and depreciation.

The plant consists of a 17-kilowatt, 125-volt, Westinghouse generator, belted to a 30-horsepower Alamo distillate engine, and an E-9 Chloride accumulator with counter electromotive force cell control. The generator is run for four or five hours each evening, during which time the battery is charged, and the battery cares for the load during the balance of the day. At present the peak load on the generator, with the battery charging, is about 13-kilowatts. When occasion requires the battery can be floated across the generator terminals and be used to help out during the heavy-load period.

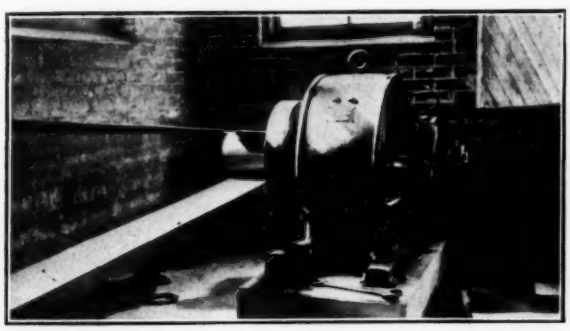
A two-wire system of distribution is used, since the plant is situated very close to the center of the load, the business section of the town is very near the plant, and the longest run is less than one-fourth of a mile. One of the two wires of the commercial circuit is used as a return for the multiple street-lighting system, thus giving independent control of these lamps by the addition of but one conductor.

Tests of the plant under regular operating conditions show a fuel consumption of less than one quart of kerosene, or distillate, per kilowatt-hour at loads of one-half or more of the rating of the generator. The entire system is substantially constructed and the cost, including a good brick building for the plant, was something less than $6,000. This plant is cared for by one attendant, who has had but a limited experience in this line of work.



Switchboard.

Building of Perry Power Plant.



17-Kilowatt Generator.

Extraordinary Life Test of Tungsten Lamps.

According to our British contemporary, *Electrical Engineering*, a group of Osram tungsten lamps has remained alight, day and night continuously, for four years (over 36,000 hours) in one of the sub-stations of the Metropolitan Electric Supply Company, London, England. At last accounts they were still burning.

Philadelphia Section Activities.

The second regular meeting of the Philadelphia Electric Company Section of the National Electric Light Association for the season was held in the Franklin Institute on November 18. Preceding the meeting a dinner was held at the Continental Hotel.

The paper of the evening was on "Resuscitation from Electric Shock" by Charles A. Lauffer, medical director of the Westinghouse Electric & Manufacturing Company. As this is a subject of very general interest, representatives from the different electrical interests, including a number of large consumers, representatives from all of the hospitals and many local physicians were invited to participate in the meeting. Both visitors and members responded in large numbers and unfortunately many coming somewhat late could not gain admittance to the hall.

Dr. Lauffer dealt in a masterly yet simple and impressive manner with this very important subject. In opening his address he displayed a pair of lungs from a rabbit, mounted in a large bottle with the bottom cut off and replaced by a rubber diaphragm. As the diaphragm was thrown out, reducing the atmospheric pressure on the outside of the lungs in the air-tight bottle, the exterior atmosphere rushed into the lungs through a glass tube that was mounted in the cork of the bottle, thus illustrating the normal action of the lungs.

Dr. Lauffer called attention to the fact that the Schafer prone-pressure method of resuscitation was applicable for restoring respiration, the suspension of which had been caused in any manner. He enumerated many of the usual causes of the cessation of respiration and emphasized the extreme importance of starting the application of the method immediately. Many cases of successful restoration were cited. Dr. Lauffer briefly reviewed the work he has done in the Westinghouse works, where he has personally instructed several thousand men to become expert in the application of the Schafer method. This work has been done by giving small classes instructions in theory and

practice, the practice consisting of students taking part in the demonstration.

After Dr. Lauffer's paper, B. Frank Day, chairman, introduced W. C. L. Eglin, a member of the Commission on Resuscitation from Electric Shock, who called attention to the advantages of the Schafer prone-pressure method over the Sylvester method so long in vogue. He stated the old method was extremely laborious and practically required the use of two people, no one man being able to operate the method for more than five or ten minutes without becoming exhausted, whereas one can operate the Schafer method indefinitely. Mr. Eglin paid a high tribute to the American Medical Association, stating that the National Electric Light Association was under the deepest debt of gratitude to the American Medical Association for the support given this movement and for the services of those distinguished specialists who have given their services without compensation. Mr. Eglin read a letter from the Bureau of Mines, signed by the director, in which permission was asked to incorporate in the annual report of the Bureau of Mines, the rules published by the Association for resuscitation from electric shock.

Mr. Eglin stated that the Navy Department has adopted the report of the Commission and that the Chilean Government has also written asking permission to adopt these rules. Mr. Eglin stated that it was the hope of the Commission that these rules would receive general application and that more attention would be paid to the teaching of artificial means of respiration in medical schools and that every one should be skilled in the use of the Schafer method.

Dr. Maddox, of Chester, discussed the paper of the evening and felt that more emphasis should be placed upon this important method by medical schools and felt that it would have a more important place in the future curricula than it has had in the past.

The discussion was followed by a demonstration of the Schafer method directed by Dr. Lauffer and Mr. Eglin. This was participated in by representatives from the various departments of the company, through whom it is hoped that the general body of employees will become more generally acquainted with the application of the Schafer method. After a lengthy demonstration, the discussion was again continued and participated in by a very large number of those present. Dr. Lauffer said that the discussion would add very largely to the value of his paper and he hoped to incorporate many points brought out by the discussion. A small booklet containing the rules for resuscitation from electric shock was distributed to those attending the meeting.

The second meeting of the Meter Department Branch of the Company Section was held on November 1. The meeting was addressed by William Bradshaw, of the Westinghouse Electric & Manufacturing Company. This well known pioneer in the design of the induction watt-hour meters discussed many problems incident to the design and manufacture of the electric meter. A very animated discussion followed the address and was participated in by a large number of those present, after which the entertainment which is the usual feature of these meetings, was carried out under the direction of Frank L. Ruschmann.

The second meeting of the Accounting Department Branch was held on November 12. Vice-Chairman G. P. Landwehr presided. The first paper of the evening was "Filing and Indexing and its Aid to Modern Business," by W. L. Cowperthwait. The paper was well received and greatly enjoyed by those present. A general discussion followed.

George A. Henrich, district manager of the Burroughs Adding Machine Company, spoke upon the theme "The Advance of Clerks in the Accounting Department." Mr. Henrich showed that he was a veteran in the business world, and gave some very sound advice. A general discussion followed and was participated in by H. R. Kern, company auditor, and Joseph B. Seaman, secretary of the Section, and many other members.

B. Frank Day spoke encouragingly of the work of the department and emphasized the importance of department employees remaining active in the work.

The second regular meeting of the Commercial Department Branch was held on November 25, Walter T. Dyre presiding.

The special subject of the evening was "Heating Appliances," which consisted of the reading of F. W. Smith's paper as originally presented at Association Island. Various members were assigned to various parts of the discussion that was given on Mr. Smith' paper.

This type of meeting, while first giving rise to the impression that it would be somewhat burdensome, has proven very successful and will serve as a ready means of adding to the education of the various members those vital points brought out in papers and discussions at the various annual conventions.

The employees of the Philadelphia Electric Company gave an amateur theatrical performance at New Mercantile Hall, Philadelphia, on Wednesday evening, November 20. The play, called "A Cheerful Liar," was followed by a dance.

THE BORDERLAND OF ELECTRICITY.

Presidential Address by W. Duddell to the Institution of Electrical Engineers.

At the meeting of the (British) Institution of Electrical Engineers in London on November 14, the newly elected president, W. Duddell, delivered his presidential address.

In his references to the subjects "on the borderland between electricity and the other sciences," Mr. Duddell considered (1) Electricity and Chemistry; (2) Electricity and Sound; (3) Electricity and Radiation.

Electricity and Chemistry.

We are all of us acquainted with the brush discharge, yet how much do we know of its mechanism?

Now the electric discharge has a peculiar property of producing that modification of oxygen known as ozone, which is without doubt a strong sterilizing agent, and which may in the future have considerable applications. A modification of the conditions of the production of the discharge will cause the formation of oxides of nitrogen instead of oxides of oxygen. Oxides of nitrogen are of great commercial importance, and their production by electrical means will probably be one of the most important industrial applications of electricity.

Already in Norway between 100,000 and 120,000 kilowatts are employed working day and night for this purpose, and it is stated that this power will shortly be increased to nearly 250,000 kilowatts. The main object of fixing the atmospheric nitrogen is to form a substance to replace Chili saltpetre. The demand for this is yearly growing. As far as one can see the price of the material in the future is likely to rise rather than fall, so that the electrically produced substitute will be able to compete more easily.

What is the mechanism, what are the causes which determine whether when an electric discharge takes place the nitrogen or the oxygen of the air will be oxidized? Certain forms of the arc discharge seem especially favorable to the production of the oxides of nitrogen. It appears that a high temperature is required to oxidize the nitrogen, but that at a lower temperature the oxides of nitrogen which have been formed decompose again, so that it is necessary to remove and cool the nitrogen compounds after formation as quickly as possible to prevent them from being destroyed.

The properties of the different compounds of oxygen and nitrogen and the active modifications of oxygen and nitrogen—for an active modification of nitrogen has lately been discovered by

Professor Strutt—are really in the domain of chemistry, so we are here on the borderland between electricity and chemistry, a borderland in which one of the largest of electrical industries is already in its inception.

Although much work has been done on the subject of the nature of the discharge which produces the greatest proportion of oxidized nitrogen, yet I feel that the last word on this subject has by no means been said, and possibly a simple observation of some peculiarity of the electrical discharge may form the key to greatly improving the efficiency. Should this be the case a large nitrate-producing industry may grow up around the coal fields of this country, an industry which will be of considerable value to agriculture.

Last year about 125,000 tons of nitrate were imported into this country. To produce the equivalent amount of fixed nitrogen per annum would, on the basis of Norwegian plants, require about 150,000 kilowatts.

At the moment I believe that the cost of electrical power is the chief stumbling block to the introduction of the manufacture on a large scale in this country.

Electricity and Sound.

The borderland between electricity and sound is so far less fruitful in interesting results. This may be due to the fact that sound consists of air vibrations; therefore all electrical methods of producing sounds resolve themselves into designing electrical motors whose work is to shake and vibrate the air. Now the telephone receiver is such an electrical motor, and the laws that govern the efficiency of electric motors in general also govern the action of the telephone receiver.

I do not know of many researches on the efficiency of the telephone receiver, yet the question is really a practical one and of considerable importance. The telephone receiver may be looked upon as an alternating-current motor. It receives electrical energy, which it converts into the mechanical form in the motion of its diaphragm, which energy is transmitted to the air as sound waves. There is no special difficulty in measuring the electrical energy supplied to the telephone receiver to a moderate degree of accuracy. The amount of this energy that is transmitted to the diaphragm is much more difficult to estimate. The real difficulty is the determination of the amount of energy of the sound waves. If we possessed any apparatus by means of which we could measure energy of sound waves we could not only determine the efficiency of the telephone receiver but the apparatus would have many other useful applications. It is curious to think that up to the present we have no unit or standard of sound. We cannot specify its strength or intensity. Even the comparison of two sounds by the ear is very inaccurate; nowhere nearly as accurate as the comparison of two lights by means of the eye. This want of standards and methods of measurement is, I believe, one of the causes that have retarded progress in the science of sound. Can electricity, the handmaid of all the other sciences, help in this direction?

Electricity has been applied to many investigations into the characteristic qualities of sounds, and especially to those qualities which characterize the vowels. Sir John Gavey, in his presidential address, and Messrs. Cohen and Shepard have published many interesting results which have been of use in enabling us to decide what is the range of frequencies for which our telephone apparatus must be constructed to enable good articulate speech to be obtained.

Electricity can be utilized for the detection of small sounds. Two microphones attached one on each side of the hull of a ship enable the sounds of distant submarine bells to be heard through the water and, further, enable the captain to tell whether the sounding bell is fore or aft or broadside on, and approximately the bearings of the bell. As a means of warning ships of the dangers of the coasts, submarine sources of sound and electrical means of detecting them are destined to play a considerable part in the future. A number of stations and ships are already equipped.

The production of electrical currents whose variations reproduce the variations of the air pressure in the sound waves is of greatest importance. The present microphone is only able to deal with comparatively small currents, and therefore, good as it seems, it has serious limitations. One cannot look upon the variations in the electric currents produced by the microphone when spoken into as truly representative of the sound waves. Microphone diaphragms possess, like most vibrating bodies, free periods of their own. One has only to produce in front of a microphone a series of notes which sound approximately equally strong, and it will be found that the current variations produced are enormously greater for some notes than for others, and that great distortions take place. There is no very great difficulty in proving that this occurs for notes with approximately the same periodic time as one of the free vibrations of the diaphragm. Another difficulty resides in the fact that the resistance of the microphone is not connected to the pressure of the sound wave in any clearly defined way, at any rate for the strengths of sound used in practice, so that the microphone must be looked upon as being very far indeed from an ideal measuring instrument. Many researches have been made to try and invent new microphones. We seem to know but little of the exact mechanism of the transfer of electricity from one body to another when they are lightly in contact. Probably a thorough investigation into the nature of contacts would reveal much useful information not only on the theoretical but on the practical side, and provide data for the design of new microphones, and for the contacts used in electrical apparatus. As an example of the extraordinary sensibility of a contact under suitable conditions, I might mention the contact in S. G. Brown's relay, which by means of an ingenious automatic electrical arrangement is kept in such a condition that one feels doubtful whether there is actual contact or not.

Electricity and Radiation.

One of the most fascinating subjects on the borderland between electricity and the other sciences is the connection between electrical energy and radiant energy, and the possibility of the mutual conversion of one form into the other.

Although at first sight this subject may seem somewhat remote from the matters which occupy the minds of electrical engineers in their daily work, yet it is of the utmost importance. Something like 500 million units are used annually for lighting purposes. Light is a short-wave-length radiation. If we think of the large plants that are installed, boilers, turbines, and generators, and all the money spent in laying mains in the streets, and if we think of this simply as a means of producing a short-wave-length radiation for the purpose of lighting our rooms and our public streets, we are led to inquire what sort of efficiency we are obtaining. We have heard much in the past of the great efficiency of electrical apparatus.

Electrical apparatus is very efficient. As our real object is the production of light—the conversion of the heat energy of the coal into the radiant energy of light—what is the overall efficiency? It is well known that it is very low. The experimental difficulties in the way of obtaining accurate figures are great. According to some tests by Dr. Drysdale, a one-candlepower source of light which emits all its energy in the visible spectrum, say between the wave-lengths 0.39 and 0.76 μ, and so distributed as to produce white light, will radiate energy at the rate of about 0.1 watt, or if the whole of the energy were to be concentrated in the wave-length to which our eyes are the most sensitive, say in the yellow-green, the rate would be about 0.06 watt per candlepower.

Looking through a number of different determinations, there seems no doubt that even with the best forms of modern metal-filament lamps, the efficiency of the conversion of electrical energy into radiation of a wave-length suitable to our eyes probably does not exceed five per cent.

If we consider the losses in the boilers and engines so as to find the overall efficiency of our means of production of light, we realize that the figure is still more unsatisfactory. The thermal efficiency of the steam engine does not exceed 20 per cent, so that the efficiency of transformation of the heat energy of the coal into radiant energy as light is well under one per cent. There is, therefore, plenty of room for improvement. The question as to whether we can improve on this unsatisfactory result leads us to consider rather closely one of the problems on the borderland, namely, the mechanism of the conversion of electrical energy into radiant energy such as light. In the great bulk of practical sources the light is obtained by heating some solid body to such a high temperature that it emits radiant energy in the form of light. This is certainly the case with ordinary incandescent lamps and arcs. The real reason that sources of light consisting of heated solid bodies are so inefficient is that these hot bodies radiate so little of their energy at wave-lengths suited to our eyes.

In the incandescent lamp there is probably very little loss by conduction and convection; practically the whole of the electrical energy is converted into radiant energy, yet unfortunately over 90 per cent of this energy is produced at wave-lengths which are too long to affect our eyes. We can shorten the wave-length at which the hot filament gives out the bulk of its energy by raising its temperature, but there is a limit to this in the temperature which the filament will stand. Probably the main reason that the metal-filament lamp is more efficient than the carbon-filament lamp is that its filament is capable of being used at a much higher temperature. This, however, need not be the sole reason, as there are some bodies which tend to concentrate their radiation in certain regions of the spectrum. The processes that are taking place in a solid body when it is radiating are not fully elucidated.

J. J. Thomson has built up a wonderful theory of the constitution of matter, in which the atoms of all bodies contain small discrete particles of negative electricity which he calls corpuscles. These corpuscles, irrespective of the nature of the body or of its state, always carry the same charge of negative electricity, and it is the movement of these charges of electricity that constitutes our electric currents.

In gases the corpuscles are looked upon as being able to move about with comparative freedom, and at very high speeds. In our metals there are two points of view; one that a number of free corpuscles are moving about between the atoms, and the other that the corpuscles are being handed backwards and forwards between one atom and another of the metal.

In all cases the conduction of electricity may be looked upon as a drift of the corpuscles carrying their negative charges.

Under this hypothesis, one of these corpuscles in movement is an electric current, and consequently produces a magnetic field, and as it carries an electric charge it also produces an electric field. The sudden starting or stopping of these corpuscles, or any change in their movement, will, therefore, produce varying electric and magnetic fields which, by Maxwell's theory, will constitute an electromagnetic radiation in the form of light, the wave-length of which will depend upon the suddenness of the starting or stopping.

According to Lorentz, collisions between the corpuscles and the atoms give rise to the radiations which we know as heat and light, and it is the nature of these collisions that determine the wave-length in the solid bodies. If some such theory as this be correct, that light is produced by the starting and stopping of electrical particles, it would seem as if we ought to be able to devise some method of producing radiation of the correct wave-lengths to suit the eye without producing a number of other wave-lengths we do not require. With regard to the very long wave-lengths, such as are used in wireless telegraphy, the result has already been accomplished, and we can produce a radiation of practically one wave-length direct with a comparatively high efficiency. Can we do the same thing with a short wave-length? Many attempts have been made to generate electromagnetic radiations of very short wave-length. The methods used in wireless telegraphy are obviously impracticable. In wireless telegraphy the wave-length of the radiation is in general several times as long as the aerial conductor used as a radiator. As light radiations have a wave-length of only 0.0005 of a millimeter, we should require stations to produce light having aerial conductors about 0.00001 millimeter long; in other words, our wireless station must be almost of molecular size.

I have already mentioned that in gases the corpuscles move about very much more freely, and we are consequently able to influence their movement by electrical means very considerably. If we make them collide violently, either with the remaining atoms of the gas or with the electrodes, radiations are produced, and these radiations are in some cases of sufficiently short wave-length to constitute light. The light given out by an atom in, say, a vacuum tube or flame has quite definite characteristics depending upon the nature of the material. It seems as if each atom contains or has circulating around it a number of corpuscles which can vibrate or move in certain definite manners depending upon their arrangement, and that these corpuscles emit, depending on their movement, radiation of certain definite wave-lengths producing the lines in the spectrum and the characteristic colors of the light of flames, etc. In the case of the flame arc we are already taking advantage of the light-emitting properties of heated gases. In the mercury arc we have another case of the production of light other than by the heating of solid bodies. In both these cases the high efficiency is probably due to the substitution of a gas for a solid body as the light-giving agent.

Unfortunately the mercury arc gives a somewhat unpleasant light owing to the greater part of its radiation being concentrated in a limited number of wave-lengths mostly in the green. The advent of fused quartz, which will stand a very high temperature, as tubes for mercury arcs, has enabled the feeble radiation of the red to be somewhat improved. Up to the present mercury is the only metal that has been used in practice. Other metals have been proposed, and lately it has been suggested to use molten cadmium, which gives a very much more pleasant light, but as this metal is a solid at ordinary temperatures, this necessitates somewhat special starting devices.

A minute trace of mercury is said to greatly improve the efficiency; according to Wolfke an efficiency of 6 Hefner candles per watt has been obtained.

Much work is quietly going on to try and completely unravel the mechanism of the transfer of electricity through gases. There is much to be hoped for along these lines. The elaborate glass apparatus, the vacuum tubes, the mercury, the liquid air, etc., which are being used in the research make the experiments look most unpromising from the practical engineers' point of view. Yet some progress is being made in electric lighting by means of the passage of electricity through gases. Many members will remember the vacuum tube 176 feet long which was used to light the courtyard of the Savoy Hotel. That tube, I believe, contained nitrogen, and according to the tests of Professor Fleming gave an efficiency of 0.56 candle per watt. About a year ago I saw a tube, not such a long tube, filled with the rare gas neon obtained from the residues in the manufacture

of liquid air. This tube gave a most beautiful rose-colored light. If this rare gas were obtainable in sufficient quantities we might have a rival to the flame arc. I may mention in passing that tubes containing neon are now commercially obtainable and are claimed, in the larger sizes, to have an efficiency as high as two candlepower per watt. Further researches on the borderland between electricity and radiation will no doubt provide us with still more efficient sources of light.

I have spoken of the production of radiation by means of electricity. Can the electrical engineer solve the converse problem on a commercial scale? When we think that the whole of the energy which is now available, either stored in the coal or in the waterfall, has reached us in the form of radiant energy from the sun, one wonders whether there is not some method by which we can trap that radiant energy and convert it direct into electrical energy without the intermediary of the plant life of past ages which has formed the coal or the evaporation of the mighty ocean which supplies the waterfalls.

Let us take a concrete example of the rate at which the earth receives radiation. I choose London because the complete data are available, although probably it will be difficult to find a much worse place, owing to the dirty atmosphere.

In a recent memoir of the Meteorological Office some curves are given of the rate of the radiation in South Kensington. From this memoir it would appear that on a clear day in September last year the maximum rate of radiation was as high as 0.07 watt per square centimeter, and the mean value between sunrise and sunset 0.04. On a dull day in October the mean radiation between sunrise and sunset was still as large as 0.007 watt per square centimeter, so that as a rough figure one might take the mean rate of radiation as being 0.01 watt per square centimeter for 10 hours a day. Hence each square kilometer of the surface of London is receiving energy at the average rate of 100,000 kilowatts during the daytime.

If an efficiency of transformation of 10 per cent could be obtained in converting the energy of radiation into electrical energy, we should have available 10,000 kilowatts per square kilometer, which would more than suffice for the present demands.

In the clear atmosphere of the Alps the radiation is much more powerful; according to Millochau and Féry it may reach 0.17 watt per square centimeter, so that the power available is probably two or three times that mentioned above.

We are at present very far from any practical means of converting the energy of radiation directly into electrical energy, although on a small scale this conversion really takes place in many photo-electric arrangements. For instance, the action of the light on the liquid potassium-sodium alloy has been shown by Professor Fleming to produce a voltage as high as 0.6 volt when the liquid alloy and a platinum plate are inclosed in a highly exhausted tube and the liquid alloy is illuminated strongly. There seems little doubt that the current that is generated in this case is produced from the energy of the light that is absorbed.

The effects so far obtained are extremely small. At the most only a few microamperes are obtainable with very strong illumination. Nevertheless, this property of sensitiveness to light, though at the moment it has no practical applications, may at any time be found to fill some useful purpose and make another case, illustrating how observations that are one day on the borderland of science may shortly afterwards be of practical use in engineering.

When it is remembered that the water power in Norway alone is estimated to produce several million kilowatts, it is evidently better, for the present at any rate, for engineers to utilize the solar radiation by harnessing the waterfalls rather than by attempting to build radiation traps in the Sahara.

The Silver Voltameter.

The earliest use of electrochemical decomposition as a means for the measurement of electricity appears to have been by Gay Lussac and Thénard about 1811, but it remained for Faraday to enunciate the conditions on which it may be used for the exact measurement of current, according to E. B. Rosa and G. W. Vinal, in an article to appear in full in the *Bulletin* of the Bureau of Standards. He declared his gas voltameter to be the "only actual measurer of voltaic electricity which we at present (1833) possess." The earliest use of the silver voltameter was by Poggendorff in 1847.

The years 1880 to 1886 were important because of the first series of absolute determinations of the electrochemical equivalent of silver. The first to be published was by Mascart, who measured his current by means of an absolute balance and obtained 1.1156 milligrams per coulomb. The work of F. and W. Kohlrausch was in terms of the horizontal intensity of the earth's magnetic field. With their tangent galvanometers and several forms of voltameter, they obtained the final result 1.1183 milligrams per coulomb. Lord Rayleigh and Mrs. Sedgwick investigated carefully the purity of their materials, the inclusions of mother liquor in the deposit, the effect of size of platinum dish, the effect of temperature, and finally designed a type of voltameter that has been much used nearly down to the present time. Their values for the electrochemical equivalent were obtained with an absolute current balance. They found 1.11794 milligrams per coulomb.

Thomas Gray in 1886 made an extended investigation both of the silver and the copper voltameters, but his form of instrument (two parallel plates in a glass beaker) has not been used by later investigations. A comparatively unknown paper by Novak, published in Bohemian in 1892, was probably the first to suggest the formation of a complex ion at the anode which yielded an excess of silver deposit on reaching the cathode. The same idea was put forward by Rodger and Watson several years later, and again proposed and emphasized by Richards, Collins, and Heimrod in 1899. The latter made no absolute determination of the electrochemical equivalent, but on the hypothesis of the heavy anode ion determined corrections to be applied to previous determinations, obtaining 1.1175 milligrams per coulomb as the mean. They originated the porous-cup voltameter, which was very satisfactory and has been much used since.

Kahle, in 1899, published the results of his extended researches on the voltameter. He noted a characteristic striated appearance of the deposit when the solution was used several times. The liberation of acid he concluded accompanied the formation of oxidation products at the anode. His value for the equivalent, using Clark cells as reference standards, was the same as found by F. and W. Kohlrausch. Leduc (1902) believed that the anode current density ought to be very small, so that the quantity of acid produced should be a minimum. He thought also that the presence of AgOH, if in solution, is not detrimental, and recommended neutralizing the electrolyte with Ag_2O. Mylius, in 1902, called attention to the possibility of producing a red silver precipitate by the action of filter paper on $AgNO_3$. The significance of this observation was apparently not appreciated until recently.

The first work at the Bureau of Standards on the voltameter was by Dr. Guthe, who in 1904 compared several different forms and particularly noted the difference between the porous-cup and filter-paper voltameters.

Van Dijk, in 1906, compared the porous-cup and filter-paper forms of voltameter, and found the difference to be 0.023 per cent, which he ascribed to the complex ion yielding an excess deposit in the former. He gives as the electrochemical equivalent of silver, 1.1180

milligrams per coulomb. Duschak and Hulett obtained a high degree of reproducibility, and made a careful analysis of their deposits, finding inclusions amounting to about 0.011 per cent.

The important recent investigations of the national laboratories of England, France, and Germany have been published by Smith, Mather, and Lowry; Janet, Laporte, and de la Gorce; Jaeger and von Steinwehr, respectively. Absolute balances were used to measure the current in the first two, and in the last the voltage of the cadmium cell was determined on the assumption that the electrochemical equivalent of silver is 1.118 milligrams per coulomb. The English and French work was based on the filter-paper voltameter.

In this investigation, ten platinum and two gold dishes have been used; four large dishes (350 cubic centimeters), four medium (175 cubic centimeters), and four small ones (125 cubic centimeters). All the dishes of one size were adjusted to the same weight to facilitate the weighings, which were made on three balances (one for each size of dish) mounted on piers in a special constant-temperature room, so arranged that the balances could be read by telescope and scale from outside the room. For weighing the dishes, similar ones reserved for tare were used, and the silver was counterbalanced by special silver weights, gold plated. Buoyancy corrections were thus eliminated. The types of voltameters were used (1) the Rayleigh or filter-paper form, (2) the Richards or porous-cup form, (3) the Poggendorff form without septum, excepting a glass cup, hung under the anode, or with silk around the anode, (4) the siphon type.

The deposits were timed automatically by a chronograph and the ticks of a standard Riefler clock. The circuit was so arranged that the current could, after adjustment be thrown on to the voltameter circuit and maintained constant to better than one part in 100,000 during the course of the experiment. Particular attention was paid to the insulation resistance. The reference standards were a Wolff manganin coil of 1 or 2 ohms in oil, and four standard cells in an oil bath maintained at a fixed temperature. The drop in potential across the standard resistance was made equal to the voltage of one of the cells and kept so by regulating the current. As a further check, a potentiometer was also included in the circuit.

All of our reference standards were frequently compared with the standards of the Bureau, and suitable corrections made whenever corrections were found to be necessary.

The first experiments were with the Rayleigh voltameter. As a mean of 37 experiments, the value of 1.01866 volts at 20 degrees centigrade for the Weston normal cell was obtained, assuming the electrochemical equivalent of silver as 1.11800 milligrams per coulomb, as defined by the London Conference of 1908. A difference of about 40 parts in 100,000 was found between this and the porous-cup form, the latter giving the lower value. It occurred to the authors that if this excess were due to the filter paper letting through a complex ion, as supposed by Richards, doubling or trebling the thickness of filter paper ought to decrease the discrepancy. But it was found that using two or three sheets of filter paper had just the opposite effect, and also increased the striations which were soon found to be a sure indication of a heavy deposit. It was found that the excess of deposit in the filter-paper form over that in the porous-cup form depended on the amount of filter-paper present, and that the porous-cup voltameter gave the same high values as the filter-paper form if filter paper were wrapped around the outside of the porous cup, or if the electrolyte had previously been contaminated by any soaking of filter paper in it.

When solutions were repeatedly used in a filter-paper voltameter, the deposits were increasingly heavy with each electrolysis, but a similar experiment with the porous-cup voltameter always gave the same weight or slightly lighter. To further test the complex-ion theory, we tried re-electrolyzing some of the electrolytes saved from inside the porous cups; this is the anode liquid which should give too heavy a deposit, if Richard's theory is correct. It was found, however, that if the electrolyte was free from filter paper the deposit was perfectly normal.

Many of the deposits were examined under the microscope, and also photographed. From pure electrolytes, the deposits were always crystalline and non-striated, and, indeed, the appearance of the deposit was found to be a good criterion of the purity of the electrolyte.

It was found that to produce a heavy deposit, it was not necessary to bring the electrolyte and filter paper together, but merely to make up the electrolyte with water that had stood over filter paper for a short time. It was evident that important chemical changes were produced in the electrolyte by the action of the filter paper on it.

With the porous-cup form, the authors obtained 1.018287 volts for the Weston normal cell at a temperature of 20 degrees.

Electricity in the Navy.

The annual report of the Secretary of the Navy each year contains more and more that is of interest to the electrical industries. The Secretary has the following to say in his report sent to Congress this year at the opening of the session this week:

"Electricity is becoming a great motive power. The General Electric Company is working out new designs for the use of electricity in connection with turbines, and it is important that in the machinery departments, both ashore and afloat, our officers should be experts in this line of work.

"The Vickers Company, England's largest shipbuilding concern, successful not only in the ships it builds, but in its returns to stockholders, indicating great efficiency and economy, has found it advantageous to group electricity and steam engineering together.

"The practice coincides with what the department adopted here. Everything points to the increased use of electricity as a motive power for the engine room of the future; therefore it would be illogical to place the design, installation, care, and maintenance of electrical machinery elsewhere than in the hands of officers who are charged with its operation and upkeep under actual service conditions at sea. This is particularly evident after three years' successful experience since the transfer of electrical work from Equipment to Steam Engineering.

Recommendation.

"To effect the principal changes found necessary it is recommended that the Bureau of Equipment be abolished, and that the Secretary be authorized to distribute its duties among other bureaus. The supplemental estimates for the coming year have been arranged in accordance with the changes desired to be made, but it is advisable to effect the changes as soon as possible by authority of law.

"The department wishes to distribute the duties of the Bureau of Equipment as follows: Coal and its transportation, to Supplies and Accounts with certain other minor matters; electric generators and accessories, electrical signal apparatus, and wireless-telegraph outfits, to the Bureau of Steam Engineering; chain and anchor manufacture, rope making and rigging of wire or rope, canvas work, galleys and fittings, and flags and bunting, to Bureau of Construction and Repair; and the Naval Observatory, Hydrographic Office, and Compass Office to the Bureau of Navigation. It has been recommended by preceding Secretaries, the only question at issue being the assignment of *equipment* electricity.

"There is no evidence that another bureau for electrical work will be required, as the electrical duties of the old Bureau of Equipment have been satisfactorily

handled for three years by the Bureau of Steam Engineering. Further, the tendency is to consolidate wherever possible so as to increase economy and efficiency."

Radiotelegraphy.

"Improvements in the radio equipment of the fleet and shore stations as regards increased range and prevention of interference during the past fiscal year have been made as rapidly as the appropriations permitted. The purchase of new radio apparatus conforming to the latest requirements is expensive, but the marked gain in efficiency makes such changes imperative.

"The high-power station at Arlington, Va., is now in operation, and messages have been exchanged with Key West and Colon. It is the first of the proposed chain of high-powered radio stations, the others to be erected on the Isthmus of Panama, on the coast of California, in Hawaii, Guam, the Philippines, and Samoa. Valuable results as regards the control of the fleet at sea and widespread dissemination of time signals and storm warnings can be obtained when these stations are erected.

"The Navy Department is maintaining 41 shore stations and six stations on light vessels. An expedition is now in Alaska modernizing and improving the older stations there and erecting a new station on the island of Unalga. The chain of Alaskan coast stations is, in conjunction with the inland Army stations, of great importance commercially, as an alternative means of communication in case of breakdown of the cable or land telegraph lines.

"As Congress has enacted legislation regulating radiotelegraphy and making obligatory the opening of certain designated naval radio stations to paid commercial business, the radio work and expenses of the department will be largely increased. It will be necessary to modernize and improve the apparatus of coast stations so that the commercial work may be successfully handled. It is expected, at the outset at least, that much of the burden of inspection for adjustment of commercial stations will fall upon this department. But the added work will undoubtedly prove an incentive to increased efficiency and will bring the naval stations into closer touch with commercial companies and their methods of operation, which, it is hoped, will mean a better appreciation of each other's work and cordial cooperation in regulation and the minimization of interference.

"The high-powered radio station at Arlington, Va., consists of two 450-foot and one 600-foot self-supporting steel towers, a building containing radio apparatus, laboratories, storerooms, offices, living quarters for operating force, etc.

"Since the introduction of high-frequency quenched-gap radio apparatus the most urgent work of the department has been the modernizing of old installations. This work has been advanced during the past year as rapidly as limited funds and the slow deliveries of contractors have permitted. Much in this line remains to be accomplished, especially in the case of coastal stations, which, as a result of pending legislation, will be thrown open to commercial work. All new ships commissioned within the year have been provided with modern apparatus, but it has not been possible to properly equip the entire fleet because sufficient funds were not available.

"With the asignment of two officers for the administration of this rapidly expanding branch it becomes possible, for the first time, to foresee a time when other and intrinsically more important features of this activity will be upon a satisfactory basis. These features relate to the development of radio for tactical purposes, experimentation in connection with purely naval needs, proper supervision and training of operators, and the standardization of material and operating methods."

In view of the great and growing use of electricity and electrical devices in the warships of the United States, the recommendations of the Secretary of the Navy to Congress as to the proposed building programme will probably prove of interest. On this subject he says:

"While only three battleships are included in the estimates for this year, the department feels that the deficiencies of the fleet in other types of ships should be carried out in accordance with the recommendations of the General Board. This board has furnished annually since 1900 a consistent and continuing program.

"The General Board, in pursuance of consistent recommendations since 1900, recommends that provision be made for an increase of the Navy at the coming session of the Congress by the addition of the following new construction; four battleships, two battle cruisers, 16 destroyers, one destroyer tender, two transports, one ammunition ship, six submarines, one submarine tender, one supply ship, two gunboats, two seagoing tugs, one dry dock, one submarine testing dock.

"The board recommends the conversion of the *Prometheus* into a repair ship, and if this is approved one fuel ship should be provided for the building program to replace the *Prometheus*. It recommends also the conversion of the cruiser *Baltimore* into a mine transport, the *San Francisco*, a sister vessel, converted to this purpose, having proved sufficiently useful to warrant the expenditure necessary to convert the *Baltimore*."

"The need for transports is considered sufficiently urgent to warrant the omission of fuel ships for one year.

As to electrical work on ships already authorized by Congress, the report says:

"Specifications covering the electrical work on the battleships *Nevada* and *Oklahoma* and other craft authorized by recent legislation have been formulated. Plans for light, power, and interior communication for new battleships *Texas, New York, Oklahoma, Nevada,* for gunboats, for destroyers 43 to 50, inclusive, having been prepared. Fixtures have been simplified and made cheaper and more durable.

"The electrical control of searchlights has been redesigned and a new mechanical control has been developed. It is hoped that the improvements made will result in a perfectly satisfactory light for naval purposes."

Electrocution for Diseased and Superfluous Animals.

The Animal Rescue League, of Boston, Mass., was organized many years ago to provide homes for stray cats, dogs and other animals and to humanely end the lives of such animals that are found to be diseased or for whom a good home cannot be found. During 1911 over 23,000 cats and kittens, 5,454 dogs, 175 horses and numerous birds, rabbits and squirrels passed through its hands. As many of these must be exterminated an electrocution outfit was developed for this purpose that has been found completely successful, both from the humanitarian and economic standpoints. It was recently described in the *Municipal Journal* and consists of one cage for dogs and four cages for cats. It is operated by one man who can destroy 200 cats or 100 dogs in an hour, while two men can destroy 300 animals in an hour.

In the bottom of each dog cage is a metal pan forming one electrode; a metal collar placed about the animal's neck forms the other. On closing the door the primary circuit is suddenly closed and the animal is instantaneously rendered unconscious. The cat cage is somewhat different in that no collar is used and in place thereof two electrode bars are in the bottom, on one of which the cat's fore feet are placed and on the other the hind feet. Closing of the cover closes the transformer primary and the high-voltage secondary current immediately passes through the animal's body. One minute is allowed for electrocuting the average cat, whereas only half a minute suffices for the average dog; the current is maintained for this period in order to make sure that the animal does not revive. There is nothing repulsive about the animal's body when it is removed from the cage.

The bodies are disposed in a gas-fired crematory. The plant is operated at the average rate of about 2,500 animal bodies each month.

New Electrical and Mechanical Appliances

Oil Drying and Purifying Outfit.

To obtain the best service as well as to economize in the use of oil for cooling and insulating transformers, high-tension switches, circuit-breakers, electrolytic lighting arresters, and similar apparatus, it is necessary to employ some method of cleaning and dehydrating the oil from time to time.

It is well known that the presence of moisture in transformer oil, even in the most minute quantities, very seriously affects the dielectric strength of the oil. Carefully conducted tests made by the Westinghouse Company have shown that 0.001 to 0.005 of one per cent (one part in 100,000 to one in 20,000) will reduce the dielectric strength below the standard test value of 30,000 volts between one-half-inch spheres spaced 0.015 inch apart, and 8 inches below the oil surface. Fine particles of carbon, dust or other foreign matter in suspension, also reduce the dielectric strength and in addition form undesirable deposits, necessitating that the oil be kept free from sediment as well as moisture.

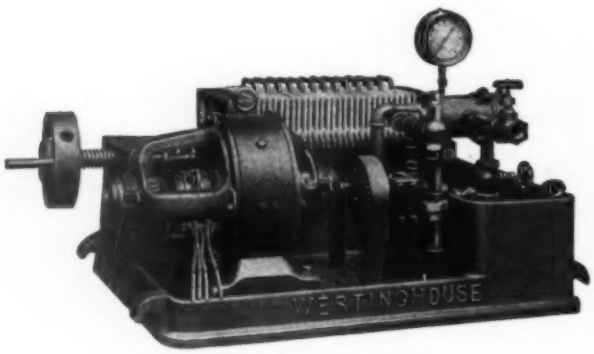
The transformer and switch oils now in use are generally stable chemically, and are subject to but very slight change due to chemical causes. Switch oils, however, from the nature of their service, suffer deterioration in time from the presence of carbonized particles of switch contacts and also of the oil itself. Both transformer and switch oils, moreover, are susceptible to moisture and even with the best care in handling and in operation will absorb water, though probably at a very slow rate. Various abnormal conditions which occasionally arise, such as transformer burnouts, accidents in cooling coils in water-cooled transformers and severe or improper operation of switches, may seriously impair the dielectric strength of the oil so that provision should be made for suitably treating the oil after such conditions.

After careful investigation of the problem of reclaiming all insulating oils whose deterioration has been caused by physical changes, or the presence of moisture, carbon, or foreign substances, the Westinghouse Electric & Manufacturing Company has designed a special type of filtering outfit for this service. In this outfit the oil is forced through several layers of specially prepared filter paper. The sediment is strained out by the first layer of paper and the moisture is taken up by the capillary action of the paper. The standard outfits are made in two sizes; the large size has a normal filtering rate of 10 to 12 gallons per minute, and the small size a normal filtering rate of 2 to 3 gallons per minute. The complete outfit consists of filter press, motor, pump, oil strainer, pressure gauge and piping, the whole mounted on a neat iron base cast with a high rim that forms an inclosure and serves as a drip pan.

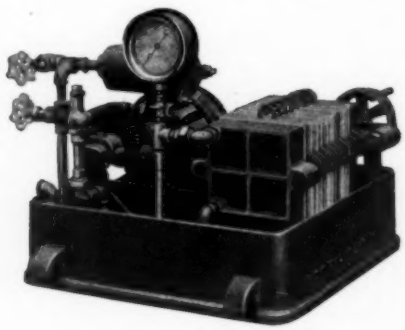
The filter press proper is made up of a series of flat cast-iron plates and frames, assembled alternately, with the filter papers between them. By means of a screw and lever and a movable cast-iron end block, the plates, frames and papers are forced tightly together. The plates are cast with small pyramids on both surfaces, except for a rim around the edge which serves to form a joint to prevent the escape of the oil. The plates and frames are cast with holes *A* and *B* in two of the corners. Supporting lugs are cast at the sides of the plates, and handles on the top edge. When the plates and frames, with the filter papers between them, are assembles, the holes *A* and *B* form respectively the inlet and outlet for the oil. Cored openings *a* and *b* connect, respectively, with the holes *A* and *B* in the frames and in the plates.

The oil entering under pressure at the top corner through the inlet formed by the holes *A* in the frames, plates and filter papers, enters by means of the opening *a* in the frames and fills each of the chambers formed between each set of two filter packs. From these chambers there is no outlet opening and the oil is consequently forced through filter papers that form the sides of the chambers. The filter paper thus takes up all the moisture and screens out all sediment from the oil. After passing through the filter paper, the oil flows along the grooves formed by the pyramid surface to the opening *b* in the corner of the plates and thence out through the outlet *B*. The pyramid surface is well adapted for its purpose, as the tops of the pyramids, being flush with the rim of the plates and spaced close together, support the filter paper against the working pressure, and the grooves readily permit the oil to pass through.

Motor-driven, rotary-gear, positive-pressure pumps are used for these outfits. A wire-mesh strainer, arranged so that it may be easily removed for cleaning, is connected in the piping to remove from the oil the larger particles of sediment before the oil enters the



Type A Oil Filter and Purifier.



Type B Oil Apparatus

pump. A by-pass is connected around the pump and provided with a relief valve set for approximately 60 pounds pressure. If the pressure should rise to this value due to clogging of the filter, the valve opens and allows a part of the oil to circulate back through the pump, thus relieving the pressure. These pumps will develop considerable suction and the oil to be treated may be readily drawn from a tank below the level of the outfit.

The electric oven for drying the filter paper before use in the filter press is substantially built of sheet iron with double walls. Adjustable slides are provided in the top of the oven for regulating the temperature and the circulation of air through the oven. The heating elements used with these ovens are known as the bayonet type and consist of slotted-ribbon resistance metal imbedded in pure sheet mica and covered by a sheet-steel shell, which makes the element practically indestructible, if used on circuits of the proper voltage range.

The best and quickest method for filtering a quantity of oil is to pump all the oil from the tank through the filter and into another tank that is dry and clean. If care is taken to change the filter papers before they become saturated, absolutely clean, dry oil will be obtained.

Plate for Oil Filter Press.

Electric Oven for Drying Filter Paper.

If the second tank for holding the oil is not available or if it is desired to filter the oil of a transformer while in service, the oil may be pumped from the bottom of the tank through the filter, and returned to the top of the same tank. This operation should be continued until the oil in the tank shows sufficiently high dielectric strength.

Railway Condulets.

One department of electrical wiring which has been largely neglected by the manufacturers of electrical appliances is that in the railway field. Here the electrician has been compelled to devise ways and means of his own to effect the desired result, and in only a few instances have appliances been at hand especially designed to aid him in his work.

Answering the demand of car builders and railway electrical engineers, the Crouse-Hinds Company, Syracuse, N. Y., has now perfected and placed upon the market a complete line of Condulets. The new designs include types for use in railway coaches, shops, roundhouses and yards, and seem to satisfy the demands.

Condulets designed for coaches include types for all sorts of fittings and fixtures for any location, whether it be on deck, sill, ceiling or side of car. There are also types for junction boxes, for telephone jacks, for battery-charging equipments, including plug and receptacle, for 100 to 200-ampere fuses for battery circuits and for connecting and disconnecting wires leading from the dynamo to the regulator in the car.

Many of the designs referred to above can also be used to advantage in shops and roundhouses. Among other Condulets in this new series, the most notable is the yard charging equipment which provides for both surface and underground conduit installation. Special 100-ampere receptacles and plugs are provided for this fitting, though other standard receptacles can be used if desired. All Condulets that are intended for use in exposed locations are thoroughly waterproof and designed to withstand hard usage.

The Low Coal-Feed Gas Engine.

According to the *Mechanical Engineer* a type of gas engine using granular coal for fuel has been perfected by A. M. Low, of London, England, and installed in a plant near that city where it is operating successfully. The machine is a four-cycle engine and develops 80 to 100 horsepower. The cylinder is 16 inches in diameter by 25 inches long and the engine runs at 140 revolutions per minute. The outfit is really a combination gas producer and engine. The coal passes from a hopper through a set of tubes through which it is drawn by worm conveyors. The tubes pass through the exhaust box and combustion chamber, so that the coal is heated to incandescence. Air and steam are drawn in at the other end and passing over the red-hot fuel form a mixture of air gas and water gas that is sucked from the tubes through small perforations leading to the inlet valve.

The engine is claimed to develop one brake horsepower-hour on one-half pound of coal. Inferior grades of the latter, such as slack, may be used. It is said that no trouble has been experienced from tar. For the first ten minutes after starting, the engine is run on coal gas or oil, then the change to solid fuel is made by means of a two-way cock.

Electric Sterilization of Water.

A plant for electrically sterilizing water has been erected at the Herring Run Station of the Baltimore County Water & Electric Company in Maryland. This method was adopted after experimentation with the various methods of filtration and the use of alum and hypochlorite of lime.

It has been found that the area required was only about one-tenth of that required for rapid sand filtration. The plant consists of a raw-water chamber, aspirator heads, ozone chambers, ozone generator and a time-contact basin or mixing cell. The function of the latter is to compel the water to move horizontally as well as vertically, thus giving a long contact with the ozone.

The ozone generator consists of a boiler-plate shell and head 30 inches high and 33 inches in diameter. A large number of aluminum tubes are inserted, inside of which are micanite tubes to serve as insulators. Inside the micanite is another tube connected to one terminal of a transformer giving from 10,000 to 15,000 volts. The other transformer terminal is connected to the shell. There is a continuous violet discharge between the inner and outer tubes, producing ozone in the air passing through. From 80 to 100 grams of ozone per kilowatt-hour are made.

The transformer is connected to the ozone generator through twin-core cables insulated with varnished cambric and sheathed with lead placed in bituminized-fiber tubes incased in concrete. All switching is done on the low-voltage side of the transformer at about 2,000 volts. Each unit or cell has a capacity of 1,000,000 gallons per 24 hours, and has a separate transformer with a capacity of five kilowatts. About 18 watts per square foot of electrode surface is required at 60 cycles.

The Bickley Motograph or Continuous Talking Sign.

The fact that moving electric display signs are much more attention-commanding than fixed signs has long been known to be based on the traits of human nature. Where the moving part of the sign consists of the reading matter thereof the advertising value of the sign is enhanced still more. This is shown by the so-called talking signs. To change the reading matter on the latter, however, usually entails considerable expense and trouble.

Bickley Motograph Applied to a Newspaper's Electric Sign.

A new type of talking sign has been invented by Everett H. Bickley, of Detroit, Mich. It is known as the Motograph and embodies some vary unique features. The most striking of these is that it continually builds up words, letter by letter, at the right end of the sign and causes them to be moved across to the left end where they break up, letter by letter. It looks as if the entire word had been carried across in solid illuminated letters, but in reality the lamps do not move. The lamps are lighted one by one, in turn, the impulse gradually moving to the left and giving the striking aspect of moving letters and words. This is accomplished in a most ingenious manner.

The Motograph really consists of two parts, (1) the bulletin board itself which is studded with closely placed vertical and horizontal rows of lamps over the entire surface where the display is to take place, and (2) the controller which performs the functions of a flasher. For each lamp on the board there is a corresponding contact on the controller. Over these contracts there travels an endless tape with perforations corresponding to the letters and words to be displayed. The principle is the same as that employed in piano players, but the action is electrical and not pneumatic. As a perforation exposes the contact for a lamp it permits the circuit for that lamp to be closed. The tape or paper ribbon is about four inches wide and 300 or more feet long, depending on how much reading matter is to appear on the bulletin before it is repeated again. The perforations can be made to reproduce any style of type and in any language; trade marks, symbols and designs can also be accurately reproduced. Copy can be easily changed; in fact, it is recommended that new matter be shown every week; the manufacturers furnish quickly and at low cost new perforated rolls in accordance with any desired copy. Arrangements can be made for almost instantaneous service, such as election returns, news bulletins and announcements.

Special devices are used to keep the paper under the proper working tension; automatic tracking and safety cutouts, together with time switches or timing devices make the operation of the machine entirely automatic, requiring only the changing of the roll and the setting of the starting and stopping mechanism. The operation can be continuous or intermittent, that is, a particular slogan or phrase can be made to stand stationary for a minute or any desired interval.

Typical Perforated Tape for Motograph.

The machine is ball-bearing throughout and the gears run in oil. All paper supports or rollers are on the overhung construction so that the ribbon may be taken out or put in without breaking the paper or disturbing the mechanical adjustment of the parts. In operation there is little wear upon the paper, one roll lasting easily several months or longer, depending upon the length of the roll and speed of operation.

Since each lamp in the Motograph bulletin requires a separate wire to the controller and the total number may vary from 300 to 6,912 lamps, special methods of trough construction have been adopted and systems of wiring whereby this multitude of wires is successfully handled and connected without confusion, complication or delay. The controller is noiseless, compact and entirely automatic and may be installed at any accessible point without risk. The bulletin panel may be erected on a steel framework on top of a building, incorporated in an existing display, be hung along the face of a building or in the front of an auditorium or theater. The speed at which the words travel may be adjusted at will up to sixty words per minute, though the advised rate is about half this figure, or the machine may be operated by hand, bringing out the reading matter only as desired. This method of operation is particularly adapted to showing the words of music as it is being played to a large audience.

Two of the illustrations herewith show large signs in which the upper portion and ornamental border are stationary, while the lower portion is operated on the Bickley Motograph principle. In the case of the newspaper this is a very striking way of calling attention to features in which it is particularly strong and which should appeal to the public. For a theater the Motograph is an extremely effective means of announcing popular features.

The cost of operation of the Motograph is very low due to the fact that only about 25 per cent of the lamps are in operation at one time—and the motor necessary to drive the controller is but one-twelfth horsepower. A sign producing a four-foot letter with 46 feet of words showing at once consumes only 2.3 kilowatts. The lamp equipment consists of 10-watt 100 to 125-volt Mazda sign lamps. This type of lamp is peculiarly adapted to the requirements of the Motograph and according to the manufacturers will give an average useful life of about three years with the intermittent burning.

The Bickley Motograph is made in standard sizes producing letters from two to twelve feet high and having a bulletin length from 24 to 144 feet. The cost of operation, with energy at four cents per kilowatt-hour, varies correspondingly from 5.5 to 63.5 cents per hour. The equipment is manufactured by the Motograph Company of America, and has been placed on the market by the Electric Sales Company, of Detroit, Mich.

Theater Sign With Motograph Announcements.

Outlet Clamps for Circular Loom.

In all knob-and-tube wiring there has been a demand for a long time for a good means of clamping the circular loom used to protect the wires just back of each outlet. Nails and staples have often been bent or driven over the loom, but they usually damage or destroy its insulation. An old method has also been to bind the loom to the gas pipe by means of friction tape; this has usually resulted in a poor mechanical job and has not prevented malicious tampering or theft after inspection.

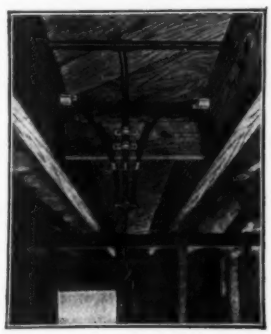


Fig. 1.—Type A Clamp Used for Combination Gas and Electric Outlet.

To meet this demand the T. W. Manufacturing Company, Majestic Building, Milwaukee, Wis., has placed on the market the two types of clamps illustrated herewith. They are made from strap steel with rounded edges to prevent injury to the loom even when it is bent at a sharp angle to the clamp. The type A clamp is used for combination gas and electric outlets, the center one of its grooves

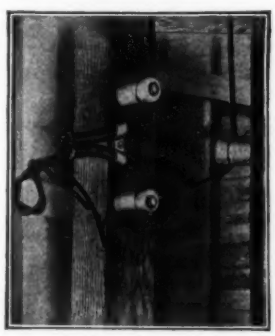


Fig. 2.—Type B Clamp Installed for Electric Switch Outlet.

fitting the gas pipe and the outer ones the looms. Where the outlet comes between two joists, a block of wood is fastened between these and the gas pipe secured to this block, as shown in Fig. 1. Where the outlet adjoins a joist or 2 by 4, the clamp is secured directly to the same, as illustrated in Fig. 2, which also shows the type B clamp for straight electric outlets and all sizes of canopies and switches.

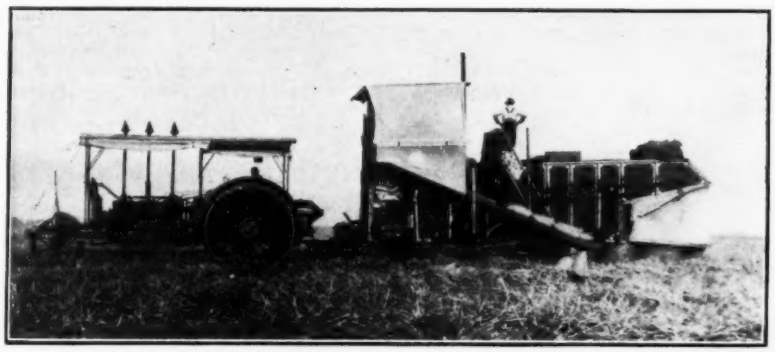
Gas-Electric Harvester.

At Elmhurst, Cal., a novel adaptation of electricity in the shape of a gas-electric harvesting machine has been at work in the fields this season.

This harvesting apparatus consists of an 80-horsepower, 6-cylinder, gasolene tractor, hauling a motor-driven harvester. On the rear of the traction engine is located a 20-kilowatt, direct-current General Electric generator, driven by a shaft extending forward and belted to the flywheel of the engine. This generator is totally inclosed to exclude dust and dirt.

Instead of a belt or rope drive for the harvester it is operated by a 25-horsepower, 230-volt, forced-ventilated motor direct-coupled to the threshing cylinder. This motor is also inclosed, being ventilated through a pipe extending above the machine.

It is claimed that this gas-electric harvesting apparatus will head, thresh, reclean and sack the grain for a total cost of 80 cents an acre, against $3.50 an acre by the old method. It will harvest approximately 2,200 bushels per day of ten hours.



Gas-Electric Tractor and Motor-Driven Harvester.

Self-Sealing Condensers.

In the early days of telephony condensers were invariably built up from solid tin foil and waxed paper. Such condensers, however, are liable to break down and become crossed or short-circuited, especially under modern conditions.

A grit in the foil or a pin hole in the paper is sufficient to cause a breakdown and the defect can seldom be made good, because the two foils become welded together by the current passing through the fault. Occasionally the weld can be burnt out by a strong current, but this generally damages the condenser seriously, because the solid foil is of appreciable thickness and requires a heavy current to fuse it. The minimum thickness of foil commercially usable is determined partly by the high cost of rolling the metal, and partly by the difficulty of handling extremely thin foil. Consequently the foil used is much thicker than is called for by the electrical conditions.

The ideal conditions of an extremely light and thin film of metal, combined with considerable mechanical strength have been attained by G. F. Mansbridge, an English telephone engineer, who conceived the idea of employing for condenser work a specially prepared metalized paper, i. e., a paper upon which is deposited an extremely thin film of pure tin, forming an even and continuous conducting layer in absolute contact with, and inseparable from, the paper.

In this combination, as recently described in the *Telegraph and Telephone Age*, the paper provides the necessary mechanical strength, and the thin film of tin the conducting electrode. The thickness of this film is such that, whereas there is ample conductivity for all telephonic currents, there is so little mechanical strength in the film alone that it instantaneously shrivels up if subjected to currents greatly in excess of its normal current-carrying capacity.

The property of shriveling up with excessive current is of great value, since a condenser made from such material is rendered proof against breakdown from internal crossing or short-circuiting. If an internal short-circuit be accidently or purposely produced, the condenser at once begins to discharge itself across the point of short-circuit and the momentary current concentrated at this point is strong enough to shrivel up the conducting film immediately surrounding the point. By this localized shriveling up, the film isolates itself from the point of breakdown, and the insulation of the condenser is preserved, since the heat developed by the transient current is insufficient to scorch the paper. This automatic sealing of the breakdown point may be repeated thousands of times, and the condenser will still retain its capacity and its insulation substantially unimpaired.

Latest Approved Fittings

AUTOSTARTERS. — Fairbanks-Morse Electrical Manufacturing Company, Indianapolis, Ind.

Type C, 10 to 100 horsepower, 110 to 2,200 volts.

Approved November 1, 1912.

BUSHINGS.—Harter Manufacturing Company, 173 West Madison Street, Chicago, Ill.

"Harter" Porcelain Bushings with metal clamping washer.

Approved November 11, 1912.

CABINETS.—Cabinets shown by tests and examination conducted by Underwriters' Laboratories to be in accordance with requirements of the National Board of Fire Underwriters and examined at the factories and passed by Underwriters' Laboratories, have standard laboratory labels attached to each cabinet.

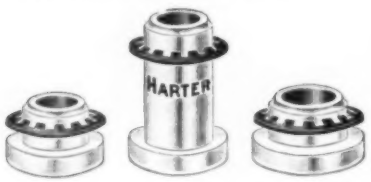
The following additional manufacturers are equipped to supply these cabinets so labeled:

H. H. Johnson, 277 Minna Street, San Francisco, Cal.

Approved October 23, 1912.

Butte Engineering & Electric Company, 683 Howard Street, San Francisco, Cal.

Approved October 22, 1912.



Harter Bushings.—Harter Manufacturing Company.

John G. Sutton Company, 243 Minna Street, San Francisco, Cal.

Approved November 9, 1912.

Western Electric Works, 213 Sixth Street, Portland, Ore.

Approved October 14, 1912.

CONDUIT OUTLET PLATES.—William Colgan Company, West Newton, Mass.

"Rex" BX outlet plates, Catalog Nos. 60 and 61, combination and straight electric old work; 80 and 81, combination and straight electric new work.

Approved October 11, 1912.

CONDUIT BOXES.—W. Douglas Woolley, 21 South Eleventh Street, St. Louis, Mo.

"Electrolet."

A porcelain fitting having a separate opening for each wire and secured over the end of a piece of conduit by means of a threaded metal plate.

Approved October 9, 1912.

The electrical fittings described in this department have been approved by the Underwriters' Laboratories, Incorporated, following examination and tests conducted under standards of the National Electrical Code as recommended by the National Fire Protection Association.

FIXTURES.—The F. W. Wakefield Brass Company, Vermilion, O.

"Utility Chain Links of stamped metal with clasp fastenings from which chain pendants of any desired length can be assembled for wiring in the usual manner.

The design and construction of these fixture parts are judged suitable for the use intended, and when assembled and wired in a manner satisfactory to inspection department having jurisdiction the completed fixtures are approved for use.

Approved September 23, 1912.

FIXTURES.—Gustav Vossberg, 529 Apple Avenue, Toledo, O.

"Vossberg" Swivel Joint Bracket Fixtures.

Approved October 3, 1912.

FIXTURE WIRE.—Standard of 1911 Edition of National Electrical Code.

The following additional companies are supplying these wires:

New York Insulated Wire Company, 114 Liberty Street, New York.

Marking: Two black threads woven into the braid, crossing each other, or one black thread woven into the braid.

Approved October 1, 1912.

The Okonite Company, 253 Broadway, New York.

Marking: Ridge on rubber insulation.

Approved October 1, 1912.

Rome Wire Company, Rome, N. Y.

Marking: One yellow and one green thread woven together in braid.

Approved October 1, 1912.

Standard Underground Cable Company, Westinghouse Building, Pittsburgh, Pa.

Marking: Green thread woven into braid.

Approved October 1, 1912.

Waterbury Company, 80 South Street, New York.

Marking: Two black threads parallel with wire between rubber insulation and braid.

Approved October 1, 1912.

FLEXIBLE CORD.—Collyer Insulated Wire Company, Pawtucket, R. I.

Marking: One blue thread parallel with the wire between rubber insulation and braid.

Standard—National Electric Code, 1911 Edition.

Approved September 28, 1912.

FUSES, PLUG.—H. T. Paiste Company, Thirty-second and Arch Streets, Philadelphia, Pa.

Paiste "Fusette."

Edison plug fuses; 6-30 amperes, 125 volts.

These fuses consist of two parts: A casing carrying a cap and screw shell, and a renewable portion of porcelain in which is carried the fuse element.

Approved November 1, 1912.

PANELBOARDS.—Jupiter Switchboard Manufacturing Company, 157 Minna Street, San Francisco, Cal.

125, 125-250 and 250 volts.

Approved November 4, 1912.

PANELBOARDS.—John G. Sutton Company, 243 Minna Street, San Francisco, Cal.

Approved November 7, 1912.

"A. W." Switch Box.—George Cutter Company.

PANELBOARDS.—Western Electric Works, 213 Sixth Street, Portland, Ore.

Two and three-wire, 125 and 250 volts.

Approved October 15, 1912.

SIGNS, ELECTRIC.—Abestile Company, Incorporated, 328 Cutler Building, Rochester, N. Y.

Approved October 19, 1912.

SOCKETS, STANDARD. — Arrow Electric Company, Hartford, Conn.

Keyless, Catalog No. 7001.

For fixture use only.

Approved October 19, 1912.

SWITCH BOXES.—Arnold-Wagner Electric Company, 128 South Main Street, South Bend, Ind.

"A. W." one-piece cast-iron switch boxes for use with flexible tubing. (Single, two and three-gang types.)

Approved October 14, 1912.

(Rights acquired by George Cutter Company, South Bend, Ind.)

Current Electrical News

LIGHTING AND POWER.

(Special Correspondence.)

THOMASVILLE, N. C.—The Jewel Cotton Mills are in the market for a used three-horsepower motor. G.

QUINCY, CAL.—The Indian Valley Electric Light & Power Company has been granted a franchise in Plumas county.

RANKIN, ILL.—The Village Board has granted a 30-year franchise to the Central Illinois Utilities Company to operate an electric light plant. Z.

SYRACUSE, N. Y.—The West End Citizens' Improvement Club has begun a movement to have an ornamental system of lighting in Burnet Park.

DUNCOMBE, IOWA.—G. J. Long has formed a company in this city for the purpose of erecting and maintaining an electric light and power plant.

LOUISVILLE, KY.—The Clark Motor Car Company is in the market for a motor for installation in a new garage which is now being erected in this city. G.

CLEVELAND, O.—Service Director Springborn is negotiating for ornamental street lamps of a universal pattern to be installed in all downtown streets.

LOCKPORT, N. Y.—Mayor-Elect G. A. Brock states that among the matters he will take up early in his administration is that of municipal lighting.

FALL RIVER, MASS.—The Fall River Electric Light Company has authorized an expenditure of over $200,000 for plant improvements to be made within a year.

JEFFERSON, TEX.—The Jefferson Light & Ice Company has been incorporated with a capital stock of $30,000 by D. C. Driskell, W. N. Driskell, M. M. Benefield, all of Jefferson.

ADAIRSVILLE, GA.—A franchise has been granted to the Georgia Railway & Electric Company over the streets of this town for the purpose of supplying electricity to the people.

BURLINGTON, IOWA.—L. R. Sherrill has been granted a 25-year franchise at Milton, Iowa, to operate an electric light system. The plant is to be in operation by July 1, next year. Z.

HERSCHER, ILL.—Officials of the villages of Cullom, Kempton, Cabery, Buckingham and Herscher have united in a movement to secure electric light and power from either Kankakee or Chatsworth. Z.

CAMDEN, N. C.—Electric pumps are wanted for the new water works system of this city, and bids for the equipment will be opened December 19. Address the Commissioners of Public Works. G.

LAKEPORT, CAL.—J. M. Hastings and J. A. Foster, of Biggs, are interested in the electric light and power company here, which plans an extension of its line to several more towns within a short time.

DUNDEE, N. Y.—It is reported that the Dundee Electric Lighting Plant is negotiating with Starkey, Lakemont and Glenora for the privilege of extending its local electric lighting system to these towns.

LEWISTOWN, ILL.—C. W. King and Albert Sandt are reported to have formed a partnership and will incorporate the Lewistown Electric Company. The power plant will be improved, it is reported. Z.

CEDARBURG, WIS.—The Common Council of this city has issued bonds in the amount of $12,000, the proceeds of which are to be used for the purpose of a new engine, switchboard and generator for the power station.

LAWRENCEBURG, KY. — The plant of the Lawrenceburg, Ky., Light & Power Company will be enlarged so as to enable service to be furnished to Versailles and Tyrone, Ky. Harry Reed is manager of the company. G.

PENN GROVE, N. J.—The Borough Council has authorized the Penn Grove Electric Light, Heat & Power Company to erect its plant. The engineers expect to complete the plant and supply current by April 1 of next year.

FREDERICKSBURG, TEX.—The owners of the Fredericksburg electric and power plant have commenced improvements to their plant, and in the near future will put in an additional dynamo besides erecting new poles and stringing new wires over the entire system in this town.

DECHERD, TENN.—The Stone Power Company has secured a franchise with W. G. Cummins to erect the necessary equipment and supply the city lighting at Decherd. The city is to be provided with modern illuminating standards through the business district, as well as with arcs. G.

SABETHA, KANS.—The Sabetha Commercial Club is interested in a proposition to establish an ornamental system of street lighting here similar to that of St. Joseph, Mo., and are obtaining estimates on the cost of same. It is said that W. R. Guild, of Sabetha, is at the head of this enterprise.

PHILMONT, N. Y.—At a special election it was decided to issue $5,000 in bonds for the purpose of erecting poles, stringing wires, supplying lamps, fixtures and other equipment for electric lighting, and the Chatham Light, Heat & Power Company has been awarded the contract for the electric lighting.

ALTON, N. Y.—It is understood that the Town Board of Sodus is planning an electric lighting district to cover the principal streets of Alton, which is five miles east of Sodus. The laying out of this lighting district is the first step toward obtaining electricity. A contract will be made for the street lights.

TELLURIDE, COLO.—Articles of incorporation have been filed for the Beaver River Power Company, this city. The company was recently granted a 50-year franchise in Caldwell, agreeing to have its lines in that city by January 1, a $5,000 surety bond being posted to guarantee the fulfillment of the agreement.

MEXICO CITY, MEX.—The Mexican Mines, Ltd., of El Oro, Mex., has applied for a concession to use the water of the Los Ocotes arroyo for the generation of electric power. The company will install a hydroelectric plant and use the power which is obtained therefrom for the operation of the machinery of its mines in the city of El Oro. D.

BRYAN, O.—This city is to have a Great White Way, the council having appropriated $5,000 to be used in providing modern cluster lighting for the business section and for the streets for one block in every direction from the business section. The clusters will be installed on standards at intervals of about 70 feet. Enlargements are being made at the municipal power plant which will make the improvements possible. H.

BALTIMORE, MD.—Electric motors for opening and closing valves are to be introduced into the Water Department of the city of Baltimore, Md. Water Engineer Whitman saw the apparatus in operation in Washington, D. C., where he inspected the improvements in the Water Department of that city. He said that through the use of motors the Baltimore department would be able to open or close a valve in three and one-half minutes. Valves are now opened and closed by hand and require from 30 minutes to a full hour.

RED WING, MINN.—It is reported that the Kelsey-Brewer lighting and power interests, who own the properties of the Red Wing Gas, Light & Power Company, as well as other properties in Wisconsin and Minnesota, are contemplating improvements and expansions to their plant. It is also reported that these interests have secured an option on the properties of the La Crosse Gas & Electric Company, which, if true, means a large amount of power being transmitted to Red Wing, which would place this city in a very favorable position for securing more manufacturing plants, etc.

MARYSVILLE, IDAHO.—A deal has been consummated whereby the Senator Clark interests of Montana have purchased the power site just above this place on the Snake River, and it is said that about $750,000 has been given over for the building of a large power plant at that place and the construction of transmission lines into Montana and Idaho. Work will

commence immediately on the gigantic task of cutting a bed for the river through some 200 feet of rock to the point where the plant will be built, giving a fall of 100 feet. It is claimed that sufficient power can be generated here to supply all of Montana and Southwestern Idaho.

TIFFIN, O.—The Ohio Light & Power Company will soon be in the market for a large amount of equipment and supplies as a result of its plan to connect its three power plants in this city, Fostoria and Fremont. A triplicate system will thus be formed which will afford almost unlimitd power. The new line will carry the service wires and also the lines of the telephone system. In case of accident at any of the three plants, adequate service can be provided from the others. Actual work of construction will begin immediately under the direction of A. T. Bull, of New York, chief engineer of the company, who has opened an office in this city. H.

SAN FRANCISCO, CAL.—A. H. Ginman, Pacific Coast manager for the Marconi Wireless System, is credited with the statement that his company is negotiating with the Pacific Gas & Electric Company to extend the latter's transmission lines to Bolinas and Marshalls. Mr. Ginman says that if these arrangements cannot be made his company will establish its own power plant. In the event of the transmission line being extended, it is considered likely that electric-train service will also be extended, which should do much toward building up that section of the country, as at present, while Bolinas is only 14 miles distant from San Francisco, it is necessary to travel 16 miles by boat and rail to San Rafael and then 23 miles by stage to reach Bolinas.

TELEPHONE AND TELEGRAPH.

(Special Correspondence.)

ROULETTE, PA.—The Roulette Telephone Company has been incorporated with a capital stock of $5,000.

PORTLAND, ORE.—The Pacific Telephone & Telegraph Company has purchased a lot and will erect a new branch telephone exchange building.

OLNEY, ILL.—The Commercial Telephone & Telegraph Company has been incorporated with a capital stock of $500,000 to build telephone and telegraph systems. The incorporators are E. G. Gregg, H. H. Kile and H. H. Knipe. Z.

, WICKLIFFE, KY.—A franchise has been sold to the Paducah Home Telephone Company and this company will begin the erection of a plant here at once. A long-distance line will also be built from Paducah to Cairo, through this place.

GAFFNEY, S. C.—The telephone company in Gaffney proposes to improve its system, replacing the old-style plan at present in operation with a common-battery system. It is necessary, however, to have the approval of the city fathers before this work can be carried out.

SPRINGFIED, ILL.—The Intertownship Telephone Company, of Shabbona, has been granted articles of incorporation with a capital stock of $5,000 to operate a telephone system. C. H. Wilkinson, E. J. Brewer and Charles H. Schermerhorn are the incorporators.

DAWSON, GA.—Articles of incorporation have been granted to the Co-Operative Telephone & Telegraph Company with $10,000 capital stock. The incorporators are J. M. Bell, C. D. Cocke, J. E. Morris, J. D. Bell, and R. R. Martin, all of this city. The line will run through Dawson, Cuthbert, Fort Gaines, Blakely and other towns.

ELECTRIC RAILWAYS.

(Special Correspondence.)

HARTFORD, CONN.—It has been decided to issue $220,000 worth of subway bonds and construct a subway around Franklin Square Park.

BUTLER, ILL.—The Village Board has granted a franchise to the Springfield & Central Illinois Traction Company to operate an interurban line through the city. Z.

REDONDO, CAL.—J. S. Torrance has promised that a double-track electric road will be constructed between Redondo Beach and the town of of Torrance within a year.

RAYMOND, ILL.—The Village Board has granted a 50-year franchise to the Springfield & Central Illinois Traction Company to operate an interurban railway through the city.

ELGIN, ILL.—Immediate steps to secure an extension of the Aurora, Elgin & Chicago interurban line from Carpentersville to the lakes region are being taken up by the Commercial Club of Elgin.

SEARCY, ARK.—Lewis R. Peebles is promoting a proposition to build an electric line from Kensett to Sulphur Springs, a distance of five and a half miles. Mr. Peebles is planning extensive improvements at Sulphur Springs.

NEWTON, ILL.—The City Council has granted a 50-year franchise to the Springfield & Central Illinois Traction Company. The Jasper County Board of Supervisors has granted a franchise to use the public highway for its line. Z.

HAGERSTOWN, MD.—A charter has been granted to the Hagerstown, Greencastle & Mercersburg Street Railway Company for the construction of a road on the Mercersburg pike, which the Pennsylvania State Highway Department has been objecting to.

ZANESVILLE, O.—W. Hunter Atha, of this place, has secured the necessary right of way for the construction of a traction line between Zanesville and Cambridge. It is stated that work will be commenced as soon as preliminary surveys are made.

TOLEDO, O.—The announcement has been made on good authority at Findlay, O., that the 50-mile connecting link between Findlay and Richwood, *via* Kenton, O., necessary for the trolley line to connect Toledo and Columbus, will be constructed in the near future, which means a complete line between Toledo and Columbus next year without fail. H.

SACRAMENTO, CAL.—The Northern Electric Company has been granted permission to issue $10,000,000 in bonds, most of which will be applied on the construtcion of a Sacramento-Vallejo line. The road will operate in connection with boats between Vallejo and San Francisco. Assurance is given by the company that the extension will be completed in 1913. There will also be branch lines to Suisun and Vacaville.

MUNCIE, IND.—It is reported that the Indiana Union Traction Company will build the Muncie and Alexandria traction line immediately after the Muncie-New Castle line is completed. The construction of this line was contemplated a couple of years ago but not carried out. The right of way is still available, however, and the piers for all the bridges are completed, and it is said that the line could be completed in a few weeks.

STOCKTON, CAL.—Plans are under way for the formation of a new corporation to be known as the San Joaquin Valley Company, which will be a merger of the San Joaquin Valley Railroad Company and the Modesto & Empire Traction Company. It is the intention to capitalize for $1,500,000 and the stockholders in the two old companies will be given stock in the new company in exchange for their present holdings.

WORCESTER, MASS.—Important trolley extensions are being planned for Worcester city and county, according to a proposition brought before the Legislative Investigating Committee by Judson I. Wood, of Gardner. It is proposed to build a new trolley line to begin somewhere in West Boylston territory, strike off northwest so as to accommodate West Sterling and East Princeton, go to Westminster and connect there with the line from Gardner.

CHEBOYGAN, MICH.—The Cheboygan Electric Light & Power Company is planning an interurban railroad to run between Cheboygan and Petoskey. The question of a franchise will be submitted to a special vote and if granted the company will commence construction early in January. As this line would be a great convenience to pleasure seekers and business people in general there is little doubt but that the proposition will be accepted by the people.

EL PASO, TEX.—The Stone & Webster Engineering Corporation, of Boston, Mass., will soon begin the construction of the interurban electric railway that is to run from El Paso down the Rio Grande Valley to Fabens. The franchise for the proposed line, which was held by a local committee of citizens, has been transferred to the Electric Railway Company, of El Paso, which is a subsidiary of the Stone & Webster Engineering Corporation. D.

SUITLAND, MD.—Plans to provide trolley-car facilities for Suitland and vicinity, through the extension of one of the Washington street car lines or else the equipping of an independent company between Anacostia and Suitland, are uppermost with the Suitland Improvement Association. A Railway Committee was appointed to have the matter in charge and with them remains the work of obtaining an extension of the Washington Street car lines or obtaining a charter for a new line.

VALLEY SPRINGS, CAL.—A survey for an electric railroad from Valley Springs to Mokelumme Hill, via the big marble quarry, has been completed and W. B. Clark, owner of the quarry, is trying to interest capital to build the line. It is understood that C. A. Westenberg, of San Francisco, is also interested in the same proposition. The rights of way have been secured for a greater portion of the route. The line will run up a rich mining and timber

district, and the foothills are valuable fruit land.

AUSTIN, TEX.—The proposition of granting a franchise to Walter Crawford, of Beaumont, and associates for the use of certain streets in Austin by a proposed electric street railway system, that is to be a part of an interurban electric line which is to run from this city to Lockhart, 30 miles, was favorably acted upon at a referendum election held here on November 26. It is announced that the promoters of the project will complete the organization of the company and soon begin the construction work.

DENISON, TEX.—John R. Cullinane, of St. Louis, Mo., and associates are promoting the construction of an interurban electric railway that is to run between Denison and Durant, Okla. The proposed line will be about 30 miles long. It is stated that the same interests also contemplate installing a hydroelectric plant at some point on the Red River and the construction of power transmission lines to Durant, Calera, Colbert and Denison. They also have in view the construction of an electric street railway system in Durant.

MARSHALL, TEX.—The Texas-Louisiana Traction Company, which was recently organized with a capital stock of $1,000,000 for the purpose of constructing an interurban electric line between Marshall and Shreveport, La., *via* Longview and Jefferson, Tex., has enlarged its plans, it is stated, to continue the lines from Jefferson to Mansfield, La. At a recent referendum election held at Shreveport the granting of a franchise for the use of certain streets of that city by the company's lines was authorized. It is announced that the project has been financed in Philadelphia. Major A. B. Blevins of Shreveport is one of the promoters of the enterprise. D.

BENTON HARBOR, MICH.—Providing there is no hitch in present plans early spring will see actual construction work started on the extension of the Coloma interurban line to Hartford. This road would connect with the Fruit Belt Line, which operates between Kalamazoo and South Haven. The latter road has already come under the control of the Michigan United Railways, and this system has, it is stated, completed plans for a cross state electric line, linking Detroit with these shores. It is understood that the money for this road is available, and that President Minary and General Manager Mason are working for a consummation of these plans.

PHOENIX, ARIZ.—That the company which now holds a 30-day option on the Phoenix street railway system, contemplates taking over in addition the franchises of the so-called White Line and the expenditure of close to a million dollars in the construction of electrified railway systems in the valley is a fact that has recently become known. A local man who is aware of the plans of the company holding the option, stated that every section of the recent order issued by the Corporation Commission would be complied with willingly and at once by the new company. This order involves the expenditure of over $200,000. In addition electric systems to Temple and Mesa will be built and possibly to other parts of the valley, and the present Glendale line will be rebuilt.

NEW INCORPORATIONS.

ST. LOUIS, MO.—The Robinson Electric Company has been incorporated with a capital stock of $2,000. The incorporators are E. B. Robinson, R. H. Robinson and M. P. Ellis. The company will engage in a general supply and manufacturing business.

BIRMINGHAM, ALA.—Burgoon-Mathews Electric Company has been incorporated with a capital stock of $35,000, with headquarters in this city. H. W. Mathews is president of the company; J. W. Ege, vice-president; C. E. Burgoon, secretary and treasurer.

DOVER, DEL.—The Elsmere Electric Company has filed articles of incorporation for the purpose of carrying on a general business of electrical and mechanical engineers and the manufacture of electric motive power machines. The incorporators are Robert J. Forman, Robert A. Shurter, Elsmere, Del., and Arthur H. Fargo, Batavia, N. Y. The capital stock of the company is $25,000.

GALENA, ILL.—The Galena Battery & Vehicle Company has been organized for the purpose of manufacturing a wet storage battery to be used on any electrically driven vehicle. The new battery is a recent invention and promises to revolutionize the storage battery industry. The company is composed of E. E. Winters and J. W. Hake, of Chicago; William H. Harris, of Indianapolis, Ind., and Gus E. Brown, of Galena.

HARRISBURG, PA.—Articles of incorporation have been filed in the State of Pennsylvania by Henry G. Giles, Edwin M. Giles and Louis C. Michaelson, for the charter of an intended incorporation to be called the Giles Electric & Manufacturing Company. The character of the work to be carried on will be on a basis of general engineering and construction business, and the erection and installation of electric, hydraulic, pneumatic steam power. They will buy, sell, lease and deal generally in engineering, electric and mechanical specialties.

NEW PUBLICATIONS.

TELEPHONE CIRCUITS. — We have received a reprint of the article entitled "Mesure de l'Equilibre des Circuits Telephoniques" by Bela Gati, chief engineer of the Hungarian telegraph service. This article appeared in the September number of the *Annales des Postes, Telegraphes et Telephones.*

COAL-MINE ACCIDENTS.— The Department of Mines has issued Technical Paper No. 27, dealing with coal mine accidents in the United States. It is shown that for the first eight months of this year there were 1,451 fatalities, of which 40, or 2.75 per cent, were due to electric shocks or burns. In 1911 the percentage was 3.5, and in 1910, 3.0.

RATE MAKING.—The address delivered by Halford Erickson, of the Railroad Commission of Wisconsin, before the last annual convention of the Ohio Electric Light Association, entitled "Some Principles and Facts That Should Be Considered in Making Rates for Electrical Utilities," has been published in pamphlet form by the Ohio Association, and is being distributed by Secretary D. L. Gaskill, Greenville, O. Copies can be secured for ten cents each by addressing the secretary.

BUREAU DES LONGITUDES ANNUAL.—The Annuaire pour l'An 1913, published by the Bureau des Longitudes, has been issued by Gauthier-Villars, Paris, France. This contains the usual tables and data, largely of an astronomical nature. Scientific notes which are appended include a summary of the observations of the solar eclipse of April 17, 1912, the application of wireless telegraphy in sending time signals, and the obituary addresses at the funeral of H. Poincaré. Copies may be obtained for 1.50 francs.

CENTRAL STATIONS IN AUSTRIA.—The Elektrotechnischer Verein of Vienna, Austria, is publishing a volnume of statistics of the central stations in Austria, containing a directory of about 1,000 stations supplying electricity in that country. The names of the owners and builders of the plant, the population of the towns and full data concerning voltage, power-station equipment, connected load, rates, invested capital, yearly output, etc., are given. The book also contains a list of the electric railways of the country. This volume is published at cost and may be obtained bound from the office of the society, Theobaldgasse 12, Vienna, for 75 cents if ordered before December 31; after that date the cost will be $1.00.

PROPOSALS.

TURBINES, HEATER, LIGHT PLANT, ETC.—Sealed proposals will be received at the office of the Mississippi River Commission, First and Second Districts, United States Engineer Memphis, Tenn., until December 23 for furnishing turbines, pumping sets, hot well, feed-water heater and electric light plant for hydraulic grader No. 1205. Further information may be had upon application.

ELECTRICAL FITTINGS.—Sealed proposals will be received by the Navy Department, Bureau of Supplies and Accounts, Washington, D. C., until December 23 for furnishing ignitors, complete with plugs, and spark plugs, etc., to be delivered at the Navy Yard, Brooklyn, N. Y., as per Schedule 5030, and 200 red and green motor-boat lights to be delivered at the Navy Yard, Brooklyn, N. Y., as per Schedule 5029.

GENERATING SET AND SWITCHBOARD.—Sealed proposals will be received at the office of the Bureau of Yards and Docks, Navy Department, Washington, D. C., until December 14, for furnishing two 75-kilovolt ampere stream-driven alternating-current generating sets and switchboard, to be delivered at the Navy Yard, Brooklyn, N. Y. Specifications may be obtained upon application to the Bureau.

ELECTRIC CONDUIT AND WIRING AND LIGHTING FIXTURES.—Sealed proposals will be received at the office of the Supervising Architect, Washington, D. C., until January 7 for furnishing electric conduit and wiring and lighting fixtures of a one-story building for the post-office at Abilene, Kans.; until January 8 of a two-story building for the annex to the post office at Paris, Tex.; and until January 29, 1913, of a one-story-and-basement building for the post office at Rochester, N. H. Drawings and specifications may be obtained from the office of the Supervising Architect, Washington, D. C.

FINANCIAL NOTES.

The last week has witnessed a considerable falling off in the price of some of the leading securities, and the scarcity of money proved to be again the dominent factor in the speculative markets. In the early part of the week the call rate went up to 12 per cent, the highest rate up to that time since the first week in January, 1910. Toward the end of the week the rate went up to 20 per cent, the highest since the first week in January, 1908.

The Kings County Electric Light & Power Company has authorized the issue and sale of not exceeding $5,000,000 par value of convertible, six-per-cent debenture bonds, to bear date on or about March 1, 1913, and to be payable on or about March 1, 1925; to be convertible at par into the capital stock of the company after three years and within 12 years of the date thereof. The bonds when issued from time to time will be offered to the stockholders of the company at par in proportion to their holdings of stock. At the meeting which was held on November 26, the total number of shares represented were 74,957 out of a total of 100,000.

Dividends on the 6,000 shares of preferred stock of the Northern Ontario Light & Power Company, on which a six-per-cent dividend as of January 1 was recently declared, will be computed from September 1. The stock was put out in September. Dividends become cumulative after January 1.

At annual meeting of the West End Street Railway, it was voted (all but 22 shares of 155,416 voted being in favor) to authorize the issue of 4,400 additional shares, $50 par, making entire common capital stock 254,603 shares, of $12,730,150. Proceeds are to be used for repaying to Boston Elevated amounts expended by it for permanent additions, alterations, and improvements on West End property. Retiring directors were re-elected.

The first and general mortgage five-per-cent bonds of the Blackstone Valley Gas & Electric Company of Rhode Island are now ready for exchange for the collateral trust five-per-cent bonds of the Blackstone Valley Gas & Electric Company of Maine. There are $1,716,000 of these bonds, and the new bonds mature at the same date, are callable at the same price, and interest is paid on the same dates as on the old bonds. The exchange is made by reason of the re-incorporation of the company under the laws of Rhode Island.

The American Public Service Company which recently increased its authorized capitalization to $15,000,000 preferred and $10,000,000 common stock, will be a holding company for gas and electric properties in Texas, Louisiana and Oklahoma controlled by N. W. Halsey & Company and associates. American Public Service will take over at once the gas, electric light and power, water and ice properties at Abilene, Tex. These properties were purchased some time ago by the Halsey interests. American Public Service has an authorized bond issue of $25,000,000 of which $2,000,000 will be issued at once.

The Middle West Utilities Company is negotiating for securities of several additional concerns, including most of Illinois Northern Utility Company's common stock. It is buying interurban lines on an extensive scale. It will organize an Indiana company similar to the recently organized Kentucky Utilities Company. Bankers, in a circular, say the fact is not generally known that the syndicate has extended its operations to the New England states and has a New England company operating in New York, Vermont, New Hampshire, Vermont and Maine.

The following securities have been listed on the New York Stock Exchange:

Portland Railway, Light & Power Company, $2,296,000, Portland Railway Company first and refunding-mortgage five-per-cent sinking-fund coupon bonds, due 1930, making the total amount listed $8,523,000.

Portland Railway, Light & Power Company $514,000 Portland General Electric Company first, mortgage five-per-cent coupon bonds, due 1935, making the total amount listed $8,000,000.

Philadelphia Company, $10,000,000 convertible five-per-cent coupon debentures of 1912.

Philadelphia Company $6,000,000 six-per-cent accumulative preferred stock on official notice of issuance of permanent engraved certificates in exchange for outstanding five-per-cent preferred stock; with authority to add $10,000,000 of said stock on and after January 31, 1913, on official notice of issuance of permanent engraved certificates upon conversion of convertible five-per-cent debentures of 1912; making the total amount authorized to be listed $16,000,000.

Dividends.

Arkansas Valley Railway, Light and Power Company; a quarterly dividend of 1.75 per cent on the preferred stock of the company, payable December 16, to stockholders of record November 30, 1912.

Chicago Telephone Company; the regular quarterly dividend of two per cent payable December 31 to stock of record December 28.

Mackay Companies, a quarterly common dividend of 1.25 per cent, and a preferred dividend of one per cent, both payable January 2 to stock of record December 11.

Massachusetts Electric Companies; a semi-annual preferred dividend of two per cent, payable January 1 to stock of record December 5.

Muskogee Gas and Electric Company; a quarterly dividend of 1.75 per cent upon the preferred stock of the company, payable December 16, to stockholders of record November 30.

National Gas, Electric Light & Power Company; a regular quarterly dividend of 1.5 per cent on preferred stock, payable January 1 as registered December 26.

New York & Queens Electric Light & Power Company; a quarterly dividend of one per cent, payable December 2 to stock of record November 27.

Norfolk Railway & Light Company; a semi-annual dividend of three per cent, payable December 10 to stock of record November 30.

Northern Ohio Traction & Light Company; a quarterly dividend of 1.25 per cent on the common stock, payable December 15 to stock of record November 30. This is an increase of one quarter of one per cent quarterly, placing the stock on a five per cent per annum basis.

Standard Gas & Electric Company; the regular quarterly dividend of two per cent on the preferred stock, payable December 16 to stock of record to November 30.

United Railways & Electric Company; a quarterly dividend of two per cent on the preferred stock.

Reports of Earnings.

AUGUSTA-AIKEN RAILWAY.

The Augusta-Aiken Railway & Electric Corporation, operating street railways and electric lighting and power plants in South Carolina, reports earnings for September, 1912, and the twelve months ended September 30, 1912, as follows:

	1912	1911
October gross	$42,492	$ 49,286
October net	20,558	24,326
October surplus	4,308	9,743
Twelve months gross	613,987	575,739
Twelve months net	317,248	297,479
Surplus	128,268	.....

PORTLAND RAILWAY LIGHT & POWER.

The Portland Railway Light & Power Company reports to the New York Stock Exchange for the six months ended June 30, 1912, as follows:

Gross receipts	$3,252,617
Net earnings	1,885,456
Fixed charges and taxes	1,151,352
Surplus	734,104
Dividends	500,000
Surplus	234,104
Extraordinary repairs and renewals	96,983
Surplus	137,120

PHILADELPHIA COMPANY.

The Philadelphia Company reports to the New York Stock Exchange for the five months ended Aug. 31, 1912, as follows:

Gross earnings	$2,293,268
Net after taxes	1,152,895
Other income	820,091
Total income	1,972,986
Interest, rentals, etc.	626,880
Improvements, betterments, etc...	218,566
Surplus	1,127,539
Previous surplus	5,394,152
Adjustments credit	114,986
Total surplus	6,636,677
Dividends	806,593
Miscellaneous debit items	86,795
Profit and loss surplus August 31..	5,743,287

CLOSING BID PRICES FOR ELECTRICAL SECURITIES ON THE LEADING EXCHANGES AS COMPARED WITH THE PREVIOUS WEEK.

	Dec. 2.	Nov. 25.
American Tel. & Tel. (New York)	142¼	142⅛
Commonwealth Edison (Chicago)	143⅜	144
Edison Electric Illuminating (Boston)	284½	283½
Electric Company of America (Philadelphia)	*12¼	*12¼
Electric Storage Battery Common (Philadelphia)	54	55
Electric Storage Battery preferred (Philadelphia)	54	55
General Electric (New York)	186	183
Kings County Electric (New York)	129	129
Manhattan Transit (New York)	1¾	1½
Massachusetts Electric common (Boston)	18½	18½
Massachusetts Electric preferred stamped (Boston)	77	76
National Carbon common (Chicago)	120	120
National Carbon preferred (Chicago)	117½	117½
New England Telephone (Boston)	153	154
Philadelphia Electric (Philadelphia)	23⅜	23½
Postal Telegraph and Cables common (New York)	85	84½
Postal Telegraph and Cables preferred (New York)	67½	67½
Western Union (New York)	78¼	79
Westinghouse common (New York)	83	81
Westinghouse preferred (New York)	*122	*122

*Last price quoted.

PERSONAL MENTION.

F. E. CARLVILLE, of South Bend, Ind., has assumed the management of the Independent Telephone Company at Kankakee, Ill. Mr. Carlville is a young man, but has been in the telephone business for some eight years and left the position of assistant manager of the South Bend Telephone Company to go to Kankakee.

ALBERT SCHEIBLE, who has formerly maintained an office as research engineer in the Marquette Building, Chicago, Ill., has entered into partnership with Rudolph W. Lotz for the practice of patent and trade-mark law and the soliciting of patents and registration of trade-marks in all countries. The firm name will be Lotz & Scheible, with offices at 1601 McCormick Building.

GEORGE E. A. FAIRLEY, a consulting engineer of Baltimore, Md., has been appointed assistant engineer to the Subway Commission of that city. The appointment was made by Raleigh C. Thomas, chief engineer of the commission. As the conduit loan was passed at the recent election, the Commission faces an active winter, and it was deemed expedient to appoint an assistant engineer at once.

C. O. MAILLOUX, president of the United States Committee of the International Electrochemical Commission, will attend the meeting of the Commission to be held at Zurich, Switzerland, January 13. Mr. Mailloux is also vice-president on international arrangements for the International Electrical Congress at San Francisco in 1915, and in this capacity will extend invitations to foreign technical societies to attend the Congress.

W. D'A. RYAN, director of the Illuminating Laboratory of the General Electric Company, Schenectady, N. Y., in company with J. W. Gosling, A. M. Dickerson and E. J. Edwards, has been in San Francisco, Cal., perfecting the Exposition plans and studying the proposed illuminating scheme with a view to letting the contract for lighting the Exposition grounds and its approaches. Mr. Ryan will also have charge of the lighting of the Exposition at San Diego.

H. G. WILSON, electrical engineer with Fred S. James & Company, one of the large insurance organizations of Chicago, has just returned from a trip of three weeks' duration through Arkansas and Oklahoma, where he went for the purpose of examining electrical plants on which his company is carrying insurance. Examinations were conducted with a view to a readjustment of the insurance rates, where the conditions were found to warrant such readjustment.

ROGER N. KIMBALL, after 12 years of managership of the Kenosha Gas & Electric Company, Kenosha, Wis., has resigned to become active in the management of the Chicago-Kenosha Hosiery Company, and this marks the elimination of the Kimball interests from public utility corporations in Kenosha. Years ago, before Southport became Kenosha, the Kimball interests became interested in the business of supplying illumination to Kenosha and throughout more than 60 years the Kimball family has been connected with the business. The late J. H. Kimball was interested in the first gas mains laid in this city. Mr. Kimball became general manager of the Kenosha Gas & Electric Company shortly after he completed his college course and under his direction the operations of the company have been largely extended, and now it is in complete control of the utilities of Kenosha.

WARNER M. SKIFF, formerly assistant manager of the Engineering Department, National Electric Lamp Association, has been appointed manager of the Engineering Department to succeed Glenn C. Webster, who has assumed the managership of the Tungstolier Works of General Electric Company. Mr. Skiff's promotion to his new post comes after a period of six years spent in the department, during three of which he filled the position of assistant manager. It was Mr. Skiff's fortune to be associated with a rapidly growing organization from its infancy, and with characteristic aggressiveness he took advantage of the opportunities offered.

Warner M. Skiff.

Mr. Skiff was born October 5, 1883, in Jamestown, N. Y. There he received his graded and high-school education. His technical education was obtained at Case School of Applied Science, from which he was graduated in 1906. While at Case School he became a member of the Tau Beta Pi and Phi Psi fraternities. Later he was elected to the Sigma Xi Society. During his early years Mr. Skiff obtained valuable practical experience through his connection with the Peerless Electric Company of Warren, O. In July, 1906, he joined the Engineering Department of the Lamp Association, which at that time comprised not more than a half-dozen men. The Department now employs nearly 100 engineers and specialists. Mr. Skiff is an example of the modern progressive young man of broad ideas, and is especially fitted to direct the work of the organization of which he is now the executive. He is a keen student of human nature, and his understanding of his associates serves him well in his managerial capacity. He is well known in commercial circles, and is a member of the American Institute of Electrical Engineers, the Illuminating Engineering Society, the National Electric Light Association, the Cleveland Advertising Club, and the Sons of Jove.

S. A. HOBSON was tendered a farewell banquet by his friends in St. Louis on the evening of Friday, November 29. Mr. Hobson leaves St. Louis to become western manager of the *Electrical World*, succeeding Chauncey L. Williams, who goes to New York City in the executive offices of the F. W. Dodge Company, publishers of the *Architectural Record* and other periodicals. "Sam," as he is familiarly called, is one of the best known and most highly esteemed men in the electrical fraternity. He was born ii Missouri and for some time was located in Texas with his brothers, the famous "Texas Hobsons." He organized, with his brother C. W. Hobson and C. A. Newning, the Jovian Order, and to this trio the electrical fraternity owes a great debt in the originating and a great deai of substantial development of the Jovian Order. He was president and one of the organizers of the St. Louis League of Electrical Interests. At the banquet W. A. Layman, president of the Wagner Electric Manufacturing Company, was toastmaster, and among those present were some of the foremost of the men in the electrical business in the Missouri section. Resolutions of regret at his departure were presented by A. C. Einstein, vice-president and general manager of the Union Electric Light & Power Company. F. D. Beardslee, sales manager of the Union Electric Light & Power Company, on behalf of the St. Louis electrical men, presented Mr. Hobson with a walrus-hide suitcase containing every requisite of the traveler. Toasts were offered by Walter Robbins, W. N. Matthews, S. H. Wallace, G. E. Cullinan, Fred B. Adams, William Wurdack, Ell C. Bennett, Fred Johnson, F. N. Jewett and J. C. Murphy.

OBITUARY.

CHARLES BOURSEUL a pioneer in the invention of the electric telephone, died in Paris, France, on November 25, at the age of 83. France believed him to be the original discoverer of the telephone, and at the time of the International Congress on Electricity held in Philadelphia 30 years ago, both Mr. Edison and Alexander Graham Bell paid him many warm tributes. Bourseul began the study of electricity while on military service in Algiers. He failed to pass his entrance examinations at the Polytechnique and he secured a position with the newly established telegraph department of France. On August 26, 1854, he published in *L'Illustration*, an article concerning his discoveries of the possibility of transmitting sound and speech. While he did not follow up his discoveries, his claims as a pioneer were recognized, and for many years he had been a pensioner of the Post Office Department.

DATES AHEAD.

Oregon Electrical Contractors' Association. Annual convention, Portland, Ore., December 17-18.

American Association for Advancement of Science and affiliated societies. Annual meeting, Cleveland, O., December 30-January 4, 1913.

Northwestern Cedarmen's Association. Annual meeting, Duluth, Minn., January 7-8, 1913.

South Dakota Independent Telephone Association. Sioux City, S. D., January 8-9, 1913.

Peoria Electrical Show. Peoria, Ill., January 18-25, 1913.

Ohio Engineers' Society. Columbus, O., January 21, 1913.

Illinois Electrical Contractors' Association. Annual meeting, Peoria, Ill., January 24-25, 1913.

Electrical Contractors' Association of New York State. Annual meeting, Syracuse, N. Y., January 21, 1913.

Western Association of Electrical Inspectors. Annual meeting, St. Louis, Mo., January 28-30, 1913.

National District Heating Association. Fifth annual convention, Indianapolis, Ind., May 27-29, 1913.

With the Electrical Manufacturers

The Federal Miniature Lamp Works of the General Electric Company, manufacturers of Mazda, tantalum and carbon miniature lamps, has moved the office and works from Cleveland, O., to 501 South Jefferson Street, Chicago, Ill.

W. N. Matthews & Brother, St. Louis, Mo., announce that they are now represented on the Pacific Coast by L. E. Sperry, San Francisco; B. C. Chase, Los Angeles, and H. G. Behneman, Seattle; all succeeding John R. Cole Company.

Rome Wire Company, Rome, N. Y., has sent out a most attractive calendar card for December. It shows a charmingly beautiful society belle in full evening regalia, serving refreshments from a large cut-glass bowl. Incidentally the company calls attention on the card to its varied stocks of wire ready for immediate shipment.

The Tier Engineering Company, Incorporated, 738 Security Mutual Building, Binghamton, N. Y., has been incorporated to do a consulting engineering business, making a specialty of power and electrical transmission. The company will also devote itself to plans, specifications, supervision of power plants, electric roads and traction work.

C. & C. Electric Manufacturing Company, Garwood, N. J., which took over the properties of the Garwood Electric Company on September 3, reports having taken a considerable number of orders since its organization. Its new three-wire generator is meeting with great success. The company has also taken a number of orders for slow-speed motors, in connection with modern steam heating and ventilating systems. In addition to its standard lines, its numerous specialties are in great demand.

Electrical Engineers' Equipment Company, Chicago, Ill., has issued Bulletin No. 100 devoted to outdoor high-tension switches. These switches are of the type designed and patented by F. G. Baum, from whom the company has secured a license to manufacture them in the eastern and central sections of the country. The bulletin describes and illustrates the Baum pole-top switches, which are designed for voltages up to 66,000. A combined pole-top switch and fuse is also included in this group.

The Century Electric Company, St. Louis, Mo., has purchased ground on the northeast corner of Nineteenth and Pine Streets, adjoining its present property. The company will build a seven-story fireproof building at a cost of $150,000, and work will begin within the next few weeks. Plans have been submitted and accepted by the company, and it is expected that this will be one of the most modern structures in the manufacturing section of the city. In connection with the purchase of this property there is an interesting story regarding the improvement in real-estate values in St. Louis. Mrs. E. A. W. Clymer, who sold the property to the Century Electric Company, bought it about 25 years ago for $6,000. The price paid by the Century Electric Company was $30,000, the profit to Mrs. Clymer being at the rate of about $1,000 a year since her original purchase.

Fairbanks, Morse & Company, Chicago, Ill., has secured the services of Cyril J. Atkinson, who is the inventor and patentee of the Atkinson gas producer and a number of special devices pertaining to this line. Mr. Atkinson has severed his connection with the Dornfeld-Kunert Company, of Watertown, Wis., and will bring to Fairbanks, Morse & Company the use of all of his patents. A number of these will be incorporated in the Fairbanks-Morse gas producers at once. The company will place the services of Mr. Atkinson at the disposal of those desiring to adopt its gas producers to the requirements of their respective industries.

Church-Field Motor Company, Sibley, Mich., has issued an attractive booklet devoted to Church-Field electric broughams and roadsters. These vehicles embody distinctive features that are not usually met in electric pleasure cars; the roadster, particularly, is a vehicle of sturdy design, built along the lines of a gasoline automobile. It is said to have a large radius of action and high-speed characteristics. Another feature that this vehicle possesses is the two-speed planetary transmission system. The speed control provides for ten speeds. A wheel is used for steering and on its stem are mounted the switch and control levers.

The C. F. Pease Company, 166 West Adams Street, Chicago, Ill., has issued a new 32-page booklet entitled "Everything for Blue Printing." This book describes particularly the large variety of Pease Peerless blue-printing machines, which have been adopted by many of the largest drafting rooms in this country. They are made in various sizes and can be operated continuously. An electric motor is used for driving and a group of arc lamps supplies the actinic rays needed for the printing. Included in the machine is a bath for washing the prints and a frame for drying them. The company also makes coating machines for sensitizing paper or linen, separate sheet-washing outfits, drying machines, blueprint wringers, trimming shears and other drafting-room supplies.

The Bryan-Marsh Electric Works of the General Electric Company, Chicago, Ill., has published a very interesting and useful booklet entitled "Modern Illumination." This deals principally with the industrial-heating department of the company. This department is named by engineers and specialists who have considerable experience in laying out the illumination of industrial plants, office buildings and department stores. The booklet is full of good information with regard to exact data on modern illumination of various industrial plants, and is well illustrated with typical examples showing how various illumination effects are produced. The book is the work of Jared A. Monroe, industrial engineer of the Bryan-Marsh Company. Mr. Monroe has made a very successful study of work of this character and has to his credit many installations that are operating under highly satisfactory conditions.

Dossert and Company, 242 West Forty-first Street, New York, N. Y., through its president, H. B. Logan, states that the year has been one of steadily increasing prosperity for the company. Orders for Dossert connectors have been larger than ever before, necessitating, in fact, an increase in the manufacturing capacity of machinery and operatives to the extent of 2.5 times that employed one year ago. The fact that the 1913 automobile will be virtually an electric power plant, and that a number of the leading automobile manufacturers have adopted Dossert connectors for the wiring of their starting and lighting batteries, has opened up a large new field for mechanical connectors. One of the largest orders ever placed with the company is that now being made up for the hydroelectric installation of the Panama Canal. Many new devices have been added to the line during the year, especially in the way of insulating covers for connectors of different types and sizes.

Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., has issued a number of new and interesting publications. A handsome catalog entitled "Westinghouse Electric Ignition and Lighting System" describes and illustrates in detail the new ignition and lighting system recently developed by this company for gasoline automobiles. The book is very attractively printed and bound, and gives detailed views and diagrams of the apparatus and a thorough description of its construction. A number of other automobile accessories are de-

scribed, such as the vibrating rectifier, automobile-tire vulcanizer, and wiring details used in connection with the ignition set. Descriptive leaflet 2441-A is devoted to a discussion of points of importance in selecting and applying small motors. Leaflet 2485 deals with low-pressure steam turbines, particularly to their application and operation in connection with other steam-driven units. "Textile Quarterly No. 2" is the title of a publication devoted to a discussion of motor drive in worsted and woolen mills. A number of installations are shown, together with detailed views of the Westinghouse textile motor. Folder 4231 is entitled "Westinghouse Motors" and covers the application thereof to various classes of machinery, such as wood-working shops, machine shops, printing presses, etc. Folder 4241 describes and illustrates types C and OA alternating-current watt-hour meters. Folder 4220 is devoted to Westinghouse polishing and grinding motors; the labor and time-saving characteristics of these machines for dentists, jewelers, opticians, restaurants, garages, etc., are pointed out.

Record of Electrical Patents.

Issued by the United States Patent Office, November 26, 1912.

1,045,121. Pressure and Electric Condenser Valve. G. P. Carroll, Bridgeport, Conn. Electromagnets limit and control the operation of a pressure-actuated port valve.

1,045,124. Folding and Wrapping Machine. S. C. Cox, assignor to Cox Multi-Mailer Co., Augusta, Me., and New York, N. Y. Failure of the paper extractor closes an electric circuit that stops the machine.

1,045,141 Circuit-Breaker. W. F. Hanst, Carnegie, Pa. Is controlled by a relay with a battery in its local circuit.

1,045,147. Process of Making and Mounting Commutators. F. P. Huyck, Toledo, O. A copper ring has radial slots cut nearly across it; in these is inserted insulation and the ring then mounted; the slots are finally sawed clear through.

1,045,158. Dynamo-Electric Machine. R. Lundell, New York, N. Y. Each pole is divided into two parts with a series winding around the smaller part and a shunt winding around both parts.

1,045,159. Interpole Field Magnet. R. Lundell, New York, N. Y. Has magnetic bridges of high reluctance between the tips of the main pole and adjacent interpole.

1,045,183. Wire-Covering Machine. F. S. Randall, assignor to Peerless Insulated Wire & Cable Co., New York, N. Y. Has a rotatable fiber-winder that moves about the wire and a comb encircling the wire to comb and mat the fiber thereon.

1,045,205. Transfer-Tube System. J. F. Skirrow, assignor to Lamson Consolidated Store Service Co., Newark, N. J. A pneumatic-tube system with a motor-driven air pump and electric control therefor to insure its operation for an interval after the insertion of each carrier.

1,045,212. Electrical Contact. H. F. Stratton, assignor to Electric Controller & Manufacturing Co., Cleveland, O. A flexibly supported spring contact finger for bearing against contacts on a controller drum.

1,045,253. Street-Lighting Device. T. S. Brown, Hemet, Cal. An electric lamp in a hood is disposed in the street curb.

1,045,256. Outlet Box. O. Carman, assignor to General Electric Co. A floor box with threaded bushing having a spherical flange on which a leveling plate and floor plate are adjustably mounted.

1,045,262. Trolley Hanger. R. O. Couch, Charleston, W. Va. The two wire-clamping members are interlocked and bolted together.

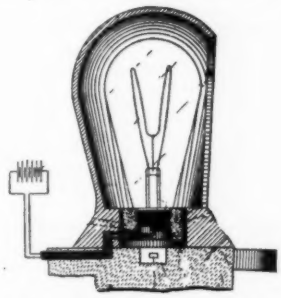
1,045,271. Signaling Circuit for Train Dispatching. J. C. Field, assignor to Western Electric Co., New York, N. Y. Has a special impulse-sending mechanism in connection with the selector.

1,045,273. Chandelier and Fixture. W. H. Fisher, assignor to General Electric Co. Removable arms extend through openings in the fixture body into sockets that lock them in place and afford electrical connection.

1,045,280. Spring Connector. T. G. Grier and H. M. Fisk, Chicago, Ill.; said Fisk assignor to said Grier. To a binding-post is secured a reversely bent spring strip whose outer bend forms a hook to clamp the wire against the post.

1,045,288. Oil Switch. E. M. Hewlett, assignor to General Electric Co. Includes fluid-pressure-operated pistons to actuate the movable contacts.

1,045,291. Battery-Charge Indication. W. E. Holland, assignor to Edison Storage Battery Co., West Orange, N. J. A cup containing liquid is connected through a vent pipe with the cell so that much bubbling indicates advanced charge.



1,045,253.—Curb-Lighting Lamp.

1,045,306. Busy-Test System for Party Telephone-Lines. F. R. McBerty, assignor to Western Electric Co. For two-party lines.

1,045,310. Sanitary Device for Telephones. I. P. Mills, San Francisco, Cal. A ring of disinfecting material is applied to the transmitter mouthpiece.

1,045,318. Automatic Keyboard-Player. C. W. Nyström, Karlstad, Sweden. Movement of the music strip energizes electromagnets that actuate the keys.

1,045,320. Electric Heater for Ranges. L. F. Parkhurst, assignor to Diamond Electric Co., Binghamton, N. Y. An electric disk heater can be set into the lid of the stove.

1,045,332. Portable Electric Welding Tool. J. W. Sheffer, assignor to American Car & Foundry Co., St. Louis, Mo. Includes a stationary and a movable electrode.

1,045,335 and 1,045,336. Transfer-Tube System. J. F. Skirrow, assignor to Lamson Consolidated Store Service Co., Newark, N. J. Modifications and further developments of No. 1,045,205.

1,045,353. Insulator for Automatically Securing Conducting Wires. F. Zachhuber, Nuremberg, Germany. Has a clamping roller wedged against the wire at the side of the bottom of a central wire-receiving groove.

1,045,357. Drum-Player. F. O. Anderson, Hamlin, Ia. An electrically actuated drum-tapper controlled by a pedal circuit-closer.

1,045,361. Rheostat. L. Beck, Norwood, O. Relates to the construction of the contact lever.

1,045,394. Automatic Switch. W. Griebe and D. C. Ruth, Brooklyn, N. Y. Movement of a keyboard apron opens and closes the switch.

1,045,405 Electric Ignition Device. T. Hubert, assignor to Splitdorf Electrical Co., Newark, N. J. Provides for interconnection of the magneto and battery circuits.

1,045,406. Magneto. T. Hubert, assignor to Splitdorf Electrical Co. Relates to the magneto brushes and a condenser associated therewith.

1,045,413. Inductive Telephone and Telegraphic Installation. H. Von Kramer, Birmingham, England. A combined telephone and telegraph system for communication with a moving railway train has an inducing wire loop on the cars.

1,045,444. Electric Piano. H. K. Sandell, assignor to Mills Novelty Co., Chicago, Ill. Includes electric hammer-actuating mechanism.

1,045,445 and 1,045,446. Lighting Fixture. L. Schepmoes, assignor to Safety Car Heating & Lighting Co. The first patent covers a car bracket with husk and shade-holder about the socket. The second relates to a deck lamp with ornamental shell and shade-holder around the socket.

1,045,450. Lamp Fixture. E. C. Sofio, assignor to Safety Car Heating & Lighting Co. A car bracket with special socket cover and shade-holder.

1,045,463 Automatic Safety Device for Railways. E. Unverricht, Hamburg, Germany. A detail of a signaling system comprises an electromagnetically actuated bolt.

1,045,496. Automobile Control. I. F. Baker, assignor to General Electric Co. Includes an engine-driven variable-voltage generator and two motors with the field of one connected in series with the armature of the other and both connected first in series and then in parallel across the generator.

1,045,515. Telephone-Exchange System. E. E. Clement, assignor to North Electric Co., Cleveland, O. A partly manual and partly automatic system.

1,045,536. Insulator Pin. C. G. Ette, assignor to Ette Investment Co., St. Louis, Mo. A metal pin with a screw-

threaded head arranged to permit longitudinal expansion and contraction without cracking the insulator.

1,045,538 Trolley Mechanism. D. T. Fisher, Columbus, O., assignor to Jeffrey Manufacturing Co. A trolley-pole socket with two compression springs.

1,045,542. X-Ray-Tube Vacuum-Controller. C. Gaveau, New York, N. Y. Permits the admission of a predetermined amount of air.

1,045,546. Central-Energy Telephone System. C. L. Goodrum, assignor to Stromberg-Carlson Telephone Manufacturing Co. Relates to a special arrangement of repeating coils.

1,045,572. Switch and Connecting Device for Electric Conductors N. D. Levin, Columbus, O., assignor to Jeffrey Manufacturing Co. A mine switch inclosed in a flameproof casing.

1,045,581. Foldable Shoe for Third-Rail Electric Cars. L. A. McCoubrie and C. F. Raydure, Philadelphia, Pa. Can be turned upward.

1,045,584. Electric Rat Trap. W. S. Mock, Edgewood, Pa., assignor of one-

1,045,697.—High-Tension Tool.

half to R. A. Robinson. The electrocution terminals are in the secondary circuit of an induction coil.

1,045,588. Holder for Globes or Reflectors. E. F. Mould, assignor to Adams-Bagnall Electric Co., Cleveland, O. Has a spring locking device adapted to have some of its parts engage a ring seat and others slots in the globe.

1,045,600 Telephone Transmission System. J. C. R. Palmer, assignor to Western Electric Co. Provides for special connections in a number of telephone stations that are in parallel across the line.

1,045,602 to 1,045,604. Heating System. A. G. Paul, Boston, Mass. Include thermostatic electric valve control.

1,045,615. Electric Soldering-Iron. F. A. Sandstrom, Chicago, Ill., assignor of one-half to F. Benjamin. Provides an arc between a carbon stick and the internal walls of the head.

1,045,626. Terminal for Branch Lines of Different Cross-Section. H. Starcke, Cologne, Germany. Has sheet-metal clamping plates secured by bolts.

1,045,637. Rotary Advertising Attachment for Theatrical Curtains. J. C. Taylor, Baltimore, Md. An electric motor-driven windmill on the arms of which "ads" appear.

1,045,638. Electrothermostatic Temperature-Controller. B. F. Teal, Glenside, Pa. A thermostat controls motor-actuated dampers

1,045,641. Vapor Electric Device. E. Thomson, assignor to General Electric Co. The vacuum is improved by maintaining a cathode blast that drives the gas through a small orifice into an auxiliary chamber that is then sealed off.

1,045,647. Speed-Indicator. H. R. Wallace, East Auburn, Cal. A centrifugal flyball moves a contact over various indicator circuits.

1,045,659. Fuse. J. H. Alspach, Pittsburgh, Pa. A cartridge device with fuse sleeves between the shell and caps.

1,045,662. Electrocuting Device. J. Balint, Cincinnati, O. An electric rat trap.

1,045,676. Electric Rat Trap. R. Clifford, Greensburg, Pa., assignor of one-third to J. D. Linardos and one-third to F. Contaxes. Electrodes are controlled by the movement of a platform.

1,045,679. Tool for Manipulating Wires on High-Voltage Circuits. J. Cronin, assignor to Cronin Electrical Appliances Co., Wapakoneta, O. A stem with opposing spurs is mounted on top of an insulator secured to a handle.

1,045,680. Implement for Manipulating Wires on High-Voltage Circuits. J. Cronin, assignor to Cronin Electrical Appliances Co. A long rod carries an insulator on which are mounted two opposed wire loops.

1,045,686. Indicator. A. F. Dixon, assignor to Western Electric Co. Electromagnets control indicating wheels.

1,045,689. Process of Cleaning Beer-Yeast G. Erdmann, Berlin, Germany. Consists in aerating the yeast, treating with water, and subjecting to the action of an electric current.

1,045,692. Electric Switch. A. G. Fitzgerald, Haverhill, Mass. A solenoid controls the longitudinal and rotary movement of a brush.

1,045,696. Attachment for Flying Machines. C. M. Gould, Collinsville, Conn. Tilting of the craft closes the electric ignition circuit of exploders that put a parachute in operative position.

1,045,697. Cable-Terminal Structure. S. P. Grace, assignor to Western Electric Co., Chicago, Ill. A terminal box with an air bell is mounted on a wall bracket.

1,045,703. Arc-Lamp Cutout. C. A. B. Halvorson, Jr., assignor to General Electric Co. In a socket are three loose ball contacts urged together by springs; line terminals are connected to two of the balls.

1,045,706 Electric Horn. M. E. Hepburn, Elgin, Ill. Has an electromagnetically vibrated diaphragm.

1,045,725. Telephone Bell. L. McMinn, Knoxville, Tenn. Has a U shaped attachment secured to the rim of the gong, between the arms of which the hammer vibrates.

1,045,733. Electric Switch. A. H. Nero, assignor to Arrow Electric Co., Hartford, Conn. A lamp socket has a separate switch block and an interposed switching member.

1,045,735. Electric Time-Switch. O. P. Noisom and O. P. Lunde, South Bend, Ind. Relates to the switch-driving mechanism.

1,045,758. Trolley. L. J. Tetlow, assignor to Universal Trolley Wheel Co., Northampton, Mass. Special contact springs bear against the hub of the wheel.

1,045,760. Tire-Inflater. W. A. Vinson, Healdsburg, Cal. Has electric control for the clutch of the air compressor.

1,045,773. Quick-Action Electric Switch. J. A. Cole, New York, N. Y. The switch is sealed in a box and operated by a toggle moved by a lever in front of the switchboard.

1,045,781 and 1,045,782. Wireless Telegraphy. R. A. Fessenden, assignor to National Electric Signaling Co., Pittsburgh, Pa. Two types of wave-detecting receivers, the first comprising two relatively movable frictionally engaged conductors, the second a fine wire suspended near a high-frequency surface.

1,045,800. Light Attachment for Firearms. C. A. Lewis, Portland, Ore. The butt of the revolver contains a battery and switch for an electric sight lamp.

Patents That Have Expired.

The following is a list of electrical patents (issued by the United States Patent Office) that expired December 3, 1912.

550,574. Electric Arc Lamp. T. E. Adams, Cleveland, Ohio.

550,577. Electric Switch. C. Bach, Jr., Milwaukee, Wis.

550,600. Electric Arc Lamp. S. Doubrava and J. Donat, Brunn, Austria-Hungary.

550,638. Electric Protective Appliance. A. H. McCuloch, Boston, Mass.

550,663. Dynamo-Electric Machine

1,045,800.—Revolver Sight Lamp.

for Plating. W. M. Thomas, Chicago, Ill.

550,666. Dynamo-Electric Machine. H. P. White, Kalamazoo, Mich.

550,670. Signal Circuit. J. V. Young, Boston, Mass.

550,686. Electric Cigar-Lighter. J. F. McLaughlin, Philadelphia, Pa.

550,688. Electrotherapeutic Apparatus. C. Palmleaf, Seattle, Wash.

550,692. Armature. H. G. Reist, Schenectady, N. Y.

550,728. Automatic Telephone-Exchange System. J. G. Smith, New York, N. Y.

550,729. Automatic Exchange System. J. G. Smith, New York, N. Y.

550,733. Electric Safety Device. E. Thompson, Lynn, Mass.

550,765. Signaling Apparatus for Telephone Switchboards. C. E. Scribner, Chicago, Ill.

550,782. Method of Distributing Electricity to Electric Lighting Systems. C. M. Davis, Chicago, Ill.

550,822. Self - Winding Electric Clock. C. M. Crook, Chicago, Ill.

550,823. Electric Meter. T. Duncan, Fort Wayne, Ind.

550,857. Electric Time-Alarm Attachment. M. Wolff, New York, N. Y.

550,860. Electric Car-Lighting Apparatus. W. Biddle, Brooklyn, N. Y.

550,866. Electric Furnace. F. Chapley, Laval, France.

550,868. Automatic Electric Switch for Railways. R. V. Cheatham, Louisville, Ky.